TECHNICAL EDUCATION IN WALES

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CENTRAL ADVISORY COUNCIL FOR EDUCATION (WALES)

Technical Education in Wales

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TERMS OF REFERENCE

'In the light of contemporary changes in the industrial pattern in Wales, to consider what educational provisions should be made to serve the best interests of industry and of those employed in it.'

Foreword

By the Minister of Education

The Right Hon. Sir David Eccles, K.C.V.O., M.P.

I find this a timely and interesting Report. I hope educationists and industrialists of Wales will do so too.

The Report should help the colleges and industry to understand one another and work together. This will benefit the young people of Wales and the country as a whole.

To The Right Honourable Sir David Eccles, K.C.V.O., M.P.,
Minister of Education

Sir,

You invited the Central Advisory Council for Education (Wales) to undertake an enquiry into the educational provisions that would best serve the interests of industry in Wales and of those employed in it.

I have much pleasure in submitting their Report on this matter.

(*Signed*) ALUN OLDFIELD-DAVIES (*Chairman*).

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Introductory

This report, the result of an investigation by the Technical Panel of the Central Advisory Council for Education (Wales), is mainly a survey of the provisions for technical education in Wales. It is for the most part a factual statement supported by tabulated information both in the body of the report and in the appendices. The brief historical review with which Chapter I opens and for which the Council is indebted to Mr. Gray Jones, now of Caerleon Training College, and Dr. Roger Webster, University College, Swansea, emphasises the point that Wales has lagged behind England in providing technical education and that Great Britain as a whole has not given to technical education the attention that many other industrial countries have shown. The short sketch of the industrial pattern of Wales brings out the quite dramatic changes in the industrial structure which have happened in our generation. These changes make corresponding demands for technical education in greater variety and intensity at all levels. The levels are examined in some detail in Chapter III, and the comments of the Council on existing provisions, together with suggestions for some far-reaching and long-term proposals, are given in Chapter IV.

The report as a whole is meant not so much for the general reader as for those people who in industry, schools and colleges and in educational administration have a concern that technical education in Wales should be so organised and planned as to meet the needs of the young people of Wales in an ever-changing and increasingly complicated industrial and commercial structure.

The Council has been aware that the concurrent investigation by the Central Advisory Council for Education (England) into the educational needs of the 15 to 18-year-olds* would clearly cover some of the ground which has been examined in its Welsh aspects by ourselves but there has been no collaboration and we go further than the English Council in recommending as a long-term proposal that training for apprenticeship should become to an increasing extent the responsibility of education authorities rather than of industrial concerns and professional institutions. While it is fully realised that such a substantial if not revolutionary change in technical education cannot be applied to Wales alone and is a matter for the whole of Britain, yet we are convinced that the long-term needs of Wales demand that we think and plan on these lines.

The Council has been longer on this investigation than was at first hoped because it undertook at the request of the Minister a double remit and sought to carry out the task while it was still engaged on a survey of rural education in Wales which was submitted a year ago. Incidentally, that is one reason why there is no reference to the agricultural aspects of technical education in this report. It has also taken some time to arrange and prepare a Welsh version, for which we are indebted in the main to Dr. Gareth Evans, one of our members, who has been helped by Mr. Ellis Evans of University College, Swansea.

Our thanks are due to all witnesses who gave us the benefit of their knowledge and opinions either orally or in writing. Industrialists, members of local education authorities and teachers in technical institutions, university colleges and schools have been very ready to help us. We are particularly grateful to Dr. W. J. Thomas, H.M.I., who has had the task of assembling and analysing information and of drafting the report, to Mr. Eryl O. Davies, H.M.I., who has arranged and minuted our meetings, and to Dr. Matthew Williams, H.M.I., whose detailed knowledge of this field has been at the service of the Council whenever it was sought.

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* 15 to 18, Report of the Central Advisory Council for Education (England). Her Majesty's Stationery Office, 1959.

CHAPTER I

A Backward Glance

Britain, from 1750 to 1920, led the world in industry and manufacture, yet it was not until late in the nineteenth century that the importance of technical education was recognised. Wales, despite its heavy industries which included iron, coal, quarrying, non-ferrous mining and smelting, and a small native textile industry, lagged even further behind. It had no large centres of industries and manufactures such as Leeds, Manchester, Birmingham and Glasgow. In these areas, and in the seats of textile, chemical and engineering industries, and in London, technical instruction for the trained artisan and his foremen and managers was increasingly recognised and classes in engineering were started in Glasgow as early as 1840 and at University College, London, in 1841. In Wales, however, the need for technical skill was limited mainly to a few chemists, mining surveyors and supervising engineers. For the rank and file, instruction in simple processes sufficed; and for a long time even the under-managers and overseers needed little more than the ability to manage workmen.

Rule-of-thumb methods prevailed in the higher management of the Welsh ironworks and mines. Training for their engineers was provided largely by pupilage in a practising engineer's office followed as soon as possible by practical experience on the job.[+] Such an arrangement was hardly conducive to a scientific and technical training and where this was essential, as for the few chemists or technical managers employed, it could be had only at the Royal School of Mines in London or at some foreign centre.

It is true that several Mechanics' Institutes were established in Wales during the period 1824-50 but it would be a mistake to imagine that they gave any technical instruction to workmen at large. These institutes were relatively few and scattered in comparison with those in England, and of the twenty or so known to have existed in 1851 (four in North Wales) some were in rural market towns like Brecon and Denbigh. They were originally designed to give scientific instruction to artisans but they found this difficult because of the wide gaps in the provision of elementary education during this period. By 1850 they were being largely patronised by middle-class people and, as a corollary, they had become more concerned with recreational activities and popular lectures than with technical education.

Despite this limited provision of technical education in Great Britain compared with most continental countries, the Great Exhibition held in London in 1851 was in many ways a triumph for British industry: most of the British exhibits

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[+] Thus, Sir W. T. Lewis (the first Lord Merthyr) received his training in the office of W. S. Clark, mineral agent and engineer to the Bute Estate.

were far superior to those from abroad. Yet there was an uneasy feeling in some quarters that Britain was falling behind those of her continental competitors which were known to have developed technical education. From this sprang the demand for the provision of technical instruction for work-people and, as a result, the Science and Art Department of South Kensington was formed in 1853, a Department which in course of time developed a policy of examining in, and giving grants to, classes held in an ever-widening range of institutions:—elementary and higher grade schools, schools of science, schools of art, grammar schools, evening classes, mechanics' institutes, pupil teachers' centres and technical institutions.

Under the stimulus of South Kensington grants classes were held in several towns in Wales but instruction was almost entirely theoretical and apparatus was rarely seen. Many pupils attended these classes merely to acquire certificates to permit them in turn to augment their incomes by conducting similar classes. The absence of apparatus was true even of the elementary and higher grade schools established by the School Boards under the 1870 Elementary Education Act. Swansea School Board was progressive indeed when, in 1890, it appointed 'an able and experienced peripatetic demonstrator. His apparatus was taken around in a covered bandcart to different Board Schools.'

It is not surprising, therefore, that the activities of the South Kensington Science and Art Department had little practical effect. At the Paris Exhibition of 1867 Britain was outclassed in almost every department and the superiority of foreign exhibits was acknowledged to be due to the superior facilities for scientific and technical education both in Europe and the United States of America.

Sharp realisation of this truth led to the appointment of the Devonshire Commission (1870-75) which surveyed existing facilities for technical instruction and disseminated information about developments abroad. As a result of this new interest matters began to improve in England. The City and Guilds of London Institute provided from 1879 a good system of recognised examinations in technical and craft subjects and in 1883 the Institute founded the first modern technical college at Finsbury. There were in that year good technical schools at Bradford, Huddersfield and Manchester. The first Polytechnic had been established in Regent Street, London, under the inspiration of Quintin Hogg. Moreover, there were progressive employers like Mather and Platt who had their own technical school from 1873 to 1903, and the Brunner Mond Company which encouraged the technical training of their employees after 1884. The Royal School of Mines, London, was by this time training about 40 students a year and at Manchester and University College, London, courses in chemical technology had been firmly developed.

This was meagre enough compared with the flourishing Technical High Schools and the great Polytechnics of France, Germany and Switzerland, but compared with the provision in Wales it was abundant: all that Wales could show up to 1889 was a handful of Mechanics' Institutes, some activity in the Science and Arts classes and, at Cardiff, classes in preparation for City and Guilds Examinations, but there was no technical education worthy of the name.

This harsh verdict is well borne out by the voluminous evidence presented to the Devonshire Commission. In 1871 the Commissioners visited three Welsh endowed schools at Beaumaris, Brecon and Monmouth to find out how much science was taught in them. They discovered that not one of these schools had a laboratory or any organised instruction in science.

In 1872 Professor Warrington Smyth of the Royal School of Mines said in evidence that there were no mining classes in Wales though there were some in Cornwall and Northumberland. He thought that the ramifying valleys of South Wales with their scattered population were an obstacle to the organisation of mining classes. There was no local mining or metallurgical school at Swansea; some few South Wales pupils went to the Bristol Mining School. The owners of the South Wales smelting works (copper and zinc) recruited their managers from the Continent. Vivian, the Swansea industrial magnate, had in 1850 to get men who had passed through courses at Freiburg in Germany because there were no such courses available in England, but by 1870 some trained men were coming from the Royal School of Mines, of whom a dozen were working as managers and chemists in Wales (at Landore, Blaenavon, Dowlais, Blaina, Flint and Swansea). Coal owners in general took no interest in mining education, and did not support it.

Another witness before the Devonshire Commissioners, Lionel Brough, H.M. Inspector of Mines, considered that a mining school could be opened at Merthyr to serve a population of 100,000. This had many times been suggested but nothing came of it. The loss of capital through accidents alone—quite apart from the loss of life—would have repaid the cost. Moreover, the new deeper mines with their problems of ventilation and development necessitated scientific and technical education such as pupils apprenticed to an engineer would never obtain.

A third witness said that the Bristol School of Mines had recently closed through lack of support from coal owners but its work was continued in a mining class at his school, the Bristol Trade School: several of its pupils were from South Wales. He had recently read a paper to the South Wales Institute of Mining Engineers advocating a School of Mines for South Wales. Sir W. T. Lewis was in the chair and the proposal was warmly welcomed but, in fact, the first School of Mines in Wales (at Treforest) was not opened until nearly forty years later, in 1910.

In view of this evidence it is not surprising that there is no reference to technical education in Wales in the comprehensive reports of another Royal Commission on Technical Instruction which reported in 1884. Any attempt to improve technical education in the Principality would have to await the development of secondary education, and secondary education in Wales remained backward. Moreover, neither secondary nor technical education could be organised on a national scale until a system of local authorities had been created. Eventually the county councils and county borough councils were established in 1888 and in 1889 the Technical Instruction Act and the Welsh Intermediate Technical Education Act were passed. The first Act authorised the new county and county borough councils to levy a rate for the development of technical instruction, whereas the second ensured the development of a national system of secondary schools whose curriculum was intended to combine both a traditional grammar school education and a modern scientific and technical education. With this aim in view the Welsh county councils diverted the rate authorised by the Technical Instruction Act to the intermediate schools. In practice, however, although due emphasis was given to the teaching of science and woodwork in some intermediate schools there was little or no technical instruction. The higher prestige of traditional academic learning, and to a lesser extent the shortage of technically qualified teachers, worked against this development.

The founding of the University of Wales in 1893 put the coping stone on this developing system of national education. Provided he could secure the financial means, the able student could now proceed from the elementary through the intermediate school to the university; but this educational ladder was much more suited to the academic student than to one who sought technical education. A man who tried hard to adapt the new provision to the needs of the technical student was the first Principal of University College, Cardiff, Viriamu Jones, F.R.S.; a strong advocate of the new scientific education in secondary schools, he had come to Cardiff from Firth College, Sheffield, in 1883, and while at Sheffield had given evidence to the Royal Commission on Technical Instruction on the urgent need for developing technical education in association with the new university colleges. It was only natural, therefore, that both county and county borough councils should turn to Viriamu Jones for advice on how best to organise technical education with the funds available. His advice directed its development over the next twenty years, and emphasised its dependence on the university.

Already in 1886 he had induced the College to send a deputation to the Lord President of the Council to press for the establishment of a Chair of Engineering. The appeal failed, but the Drapers' Company provided the necesary funds for the Chair in 1890. This was the first decisive step towards higher technical education in Wales.

Under the 1889 Act the Cardiff Borough Council set up a Technical Instruction Committee to take from the Libraries' Committee the Science and Arts classes founded in 1866 and housed from 1882 in the public library. They asked the Principal for terms upon which the College would undertake the organisation of and accommodation for the technical schools and the science and arts classes, for his advice had been that facilities for technical education should be provided at the College rather than that a new technical college should be opened.

It was then agreed that the teaching could be given in evening classes at the College and that the Principal and Registrar of the College should act as Principal and Secretary of the Technical School. This arrangement continued until 1907 when the Cardiff local education authority appointed a Superintendent of Technical Instruction. The evening classes had moved to premises in Dumfries Place and eventually the Technical College was built in 1916.

The Glamorgan, Monmouthshire and Carmarthenshire County Councils in turn asked Viriamu Jones for advice, and he recommended them to open evening classes and to appoint travelling tutors and establish technical studentships at the College. This was the pattern on which they worked for the next two decades. So far as higher technical education was concerned, he still hoped to found a School of Mines and a Metallurgical Department at the College.

Meanwhile, at Swansea the Technical Instruction Committee organised their evening classes at the grammar school under its headmaster from 1896, and no change was made in these arrangements until a new technical building was erected in 1907 and day as well as evening students were admitted.

Newport was the first Welsh local education authority to open a technical college in 1910, when the science and technical classes were combined with the art classes in a new building.

The end of the century thus saw the widespread establishment of evening classes staffed by part-time or travelling tutors in the industrial areas of South Wales. For the advanced students (who might win technical studentships) University College, Cardiff, provided departments in the physical sciences and in engineering, and there was a developing system of secondary schools which, though academic in outlook, gave ample attention to science.

The chief deficiencies in technical education were the lack of integrated courses, the restriction to evening classes, the very inadequate supply of trained technical teachers and the complete absence of suitable modern premises. These deficiencies could only be removed by the thorough overhaul of the administrative system of education. This was done by the creation of the Board of Education in 1899 and by the creation of local education authorities in 1902, the one to consolidate the national administration of education by taking over the affairs of the Science and Art Department and of the Charity Commissioners so far as they related to education, and the other to give unity to the local administration of education. Henceforth the picture is a good deal brighter.

Establishment and the Development of the Technical Institutes and Colleges

During the period 1910-16 technical institutes were opened at Newport, Swansea and Cardiff, and schools of mines at Treforest and Crumlin were established by the South Wales Colliery Owners' Association. By the 1919-20 session there were 840 full-time and 6,339 part-time students in attendance at these five establishments. In addition there were 631 evening schools located mainly in existing day school buildings and attended by 48,829 students. In 1927 a technical institute was established at Wrexham and in the following year the schools of mines at Treforest and Crumlin were taken over by the Glamorgan and Monmouthshire Education authorities respectively and conducted as technical institutes.

During the latter part of the 1920s and the early part of the 1930s, a number of additional centres became available for part-time technical education. These were the mining and technical institutes which were erected in the various coal-fields by local education authorities aided by grants from the Miners' Welfare Fund. This Fund was created by the Mining Industry Act of 1920 and was used for improving the educational, social and recreational amenities of persons employed in the mining industry. The staffing and maintenance of the institutes were the responsibility of the local education authorities. They consisted usually of two classrooms, a drawing office and two science laboratories, and the courses conducted in the institutes in their early days were designed to improve the higher technical training of men engaged in the mining industry, including preparation for the statutory examinations for Mine Managers' Certificates. Since very little of this work was done during the daytime, junior technical schools were set up in the institutes to provide technical education for pupils in the 13-15 age range. (See page 24).

These Institutes, of which there were about a dozen in operation in the mid-thirties and to some of which extensions in the form of workshops and additional classrooms were added, form the nuclei of many of our present technical colleges.

The increase in the number of students attending courses at technical colleges and institutes during the period 1927-38 is shown in the following table:

Year	Senior Full-time Courses		Technical Day Courses		Evening Classes	
	Estabs.	Students	Estabs.	Students	Estabs.	Students
1927-28 ...	4	589	13	1,604	635	48,831
1929-30 ...	4	608	10	1,656	724	57,742
1931-32 ...	5	585	10	1,701	795	58,201
1933-34 ...	5	765	11	1,599	794	54,368
1935-36 ...	5	756	13	1,527	814	55,729
1937-38 ...	5	795	16	2,029	885	64,265

Establishment of National Certificate and Diploma Courses

In 1921 the Board of Education made arrangements with the Institution of Mechanical Engineers for the issue of Certificates and Diplomas in Mechanical Engineering by the Institution, in conjunction with the Board, to students who successfully completed part-time (Certificate) or full-time (Diploma) courses. Similar arrangements were also announced in connection with the Institute of Chemistry. This step heralded the beginning of the National Certificate and National Diploma schemes which play such a prominent part in our present system of technical education.

Ordinary National Certificates (O.N.C.) are awarded to students who successfully complete a part-time course, normally of three years' duration unless part exemption is obtained by virtue of qualifications such as passes at Ordinary or Advanced level of the General Certificate of Education. Exemption from the first year and even from the second year can be obtained in this way; students who do not possess the prescribed qualifications for admission to the first year of the course are required to take a preliminary course. In pre-war days these courses were, in the main, held in the evenings, and usually required attendance on three evenings a week. In the post-war years, however, evening courses for National Certificates have largely been replaced by day-release courses, the students being granted release from their employment for one day a week. A further two-year part-time course following that for an Ordinary National Certificate leads to the Higher National Certificate (H.N.C.).

Courses for the Ordinary National Diploma (O.N.D.) and Higher National Diploma (H.N.D.) differ from those leading to Ordinary and Higher National Certificates in that they demand a period of six months or more full-time attendance at a technical college each year. The course for the Ordinary National Diploma is of two years' duration, and a further three years' course leads to the Higher National Diploma. With the additional time available, the content of the Diploma Course is greater than that of the corresponding Certificate Course, and the standard of the Diploma award is higher than that of the Certificate.

Technical colleges wishing to conduct Diploma and/or Certificate courses draw up the syllabuses, giving due consideration to the needs of local industry, and submit them for the joint approval of the Ministry of Education and the professional organisation concerned. Since 1954 the Welsh Joint Education Committee has acted as a Regional Examining Body for certain Ordinary National Certificates, and by now nearly all the technical colleges in Wales concerned have opted to participate in the Joint Committee's schemes rather than prepare their own schemes for Ordinary National Certificates.

National Certificates and Diplomas differ from most qualifications in that their award depends not only on attainment at an examination but also on progress made during the course, progress which is indicated by marks gained for home-work and classwork, and by achieving a certain standard of attendance. Furthermore, examinations are set at the end of each year of the course, and a student is allowed promotion to the next year of the course only if he successfully completes the previous year in respect of examination results, attendance record and course work.

The joint control of the schemes for the award of Diplomas and Certificates by the Ministry and a professional organisation ensures appropriate educational and professional standards, and the Higher National Diplomas and Certificates are accepted by a number of professional institutions as part qualification for corporate membership.

The first courses in Wales in preparation for these Certificates and Diplomas were the Ordinary National Diploma course in mechanical engineering at Cardiff Technical College, and both Ordinary National Diploma and Ordinary National Certificate courses in mechanical engineering at Newport Technical College, instituted in 1922; some months later an Ordinary National Certificate course in mechanical engineering was started at Swansea Technical College. Courses conducted at the Schools of Mines at Treforest and Crumlin were approved for the award of National Certificates and Diplomas towards the end of the 1920s.

The numbers of students attending technical institutions in Wales who succeeded in gaining National Certificates or National Diplomas up to and including the session 1937-38 were:—

Year	Mechanical Engineering				Electrical Engineering				Building		Chemistry	
	O.N.C.	H.N.C.	O.N.D.	H.N.D.	O.N.C.	H.N.C.	O.N.D.	H.N.D.	O.N.C.	H.N.C.	O.N.C.	H.N.C.
1923-24	4 (10)	—	3 (6)	—	—	—	—	—	—	—	—	—
1924-25	12 (16)	—	7 (14)	—	—	—	—	—	—	—	—	—
1925-26	7 (14)	—	10 (13)	—	1 (2)	—	—	—	—	—	2 (2)	—
1926-27	19 (23)	—	11 (14)	—	2 (3)	—	—	—	—	—	3 (4)	—
1927-28	8 (19)	—	14 (18)	—	—	—	—	—	—	—	2 (2)	—
1928-29	4 (10)	3 (3)	9 (14)	—	5 (5)	2 (2)	—	—	—	—	3 (6)	—
1929-30	8 (9)	4 (4)	11 (14)	—	9 (10)	1 (1)	—	—	—	—	1 (6)	—
1930-31	19 (22)	—	15 (21)	3 (5)	9 (12)	3 (5)	—	—	11 (16)	5 (7)	2 (3)	—
1931-32	14 (19)	—	10 (12)	2 (3)	11 (16)	7 (7)	—	—	7 (11)	—	4 (5)	—
1932-33	15 (20)	10 (12)	11 (16)	3 (3)	12 (19)	4 (6)	—	—	5 (10)	6 (7)	2 (4)	—
1933-34	6 (10)	7 (8)	14 (17)	3 (3)	20 (22)	5 (7)	4 (9)	—	9 (12)	1 (3)	3 (6)	4 (5)
1934-35	9 (15)	4 (5)	25 (31)	1 (1)	14 (20)	7 (12)	—	—	16 (18)	3 (3)	1 (4)	1 (2)
1935-36	10 (16)	6 (6)	9 (13)	2 (3)	24 (30)	8 (10)	6 (9)	—	12 (20)	7 (10)	6 (7)	1 (1)
1936-37	12 (23)	5 (5)	10 (11)	—	25 (40)	7 (10)	7 (9)	—	14 (17)	7 (9)	2 (7)	—
1937-38	26 (33)	6 (7)	6 (14)	4 (5)	24 (50)	3 (7)	5 (12)	—	16 (18)	6 (8)	7 (10)	4 (6)

(The figures in brackets indicate the total number of candidates.)

The increase in the number taking the Ordinary National Certificate examinations in Mechanical and in Electrical Engineering in the period 1934-38—from 10 to 33 in Mechanical Engineering and from 22 to 50 in Electrical Engineering—is a reflection of the industrial development and expansion that occurred in Wales in the latter half of the 1930s. Similarly the decrease in the number of candidates for the Ordinary National Certificate examinations in Mechanical Engineering, from 22 to 15 during the period 1931-34, with a corresponding increase in the number taking the Ordinary National Diploma examinations, from 21 to 31, in the same period, was probably due to an increase in unemployment.

The First Sandwich Courses

The first sandwich course in Wales, that is to say, a course where a student spends alternate periods—normally six months—at a technical college and in industry, was the three-year Joint Mining Diploma course conducted by the School of Mines, Treforest, in association with the University College of South Wales and Monmouthshire. This started in 1913 when the School of Mines was opened. Other sandwich courses conducted at the School were a four-year course leading to the Colliery Engineering Diploma of the School of Mines which also commenced in 1913, and a four-year course for the Chemical Engineering Diploma of the School which started in 1917. Part-time day-release courses for mine surveyors, mechanics, electricians and chemists were also held at the School from 1913.

The South Wales and Monmouthshire Joint Mining Education Advisory Committee

As a result of a report issued by the Board of Education in 1924 on the provision of instruction for persons employed in the coal-mining industry in South Wales and Monmouthshire, an advisory committee known as the South Wales and Monmouthshire Joint Mining Education Advisory Committee was set up in the following year. This Committee was the first of its kind to be established in the United Kingdom and among its many valuable contributions was a common scheme of mining education for the South Wales coalfield. In 1938 the Committee became a sub-committee of the Advisory Council mentioned below.

The Advisory Council for Technical Education in South Wales and Monmouthshire

A recommendation in another report issued by the Board of Education in 1931 on 'Educational Problems of the South Wales Coalfield' led to the establishment of the Advisory Council for Technical Education in South Wales and Monmouthshire in 1935. The report commented on the decline in the South Wales export trade and migration from the area, and suggested that the technical education provided should be broadened in scope and raised in standard to meet the situation that had arisen. The Advisory Council was therefore formed with the view to establishing a closer relationship between education, industry and commerce, to obtaining a closer coordination between local education authorities, and to the elimination of overlapping and inadequate educational provision. Its record of work has been well summarised as:

> preparation of a number of publications, dealing with a wide range of subjects relating to technical education, for the guidance of Education Committees and officials, teachers, students and industrialists;
>
> establishment of schemes of assessed examinations for students attending part-time preliminary courses at technical colleges and also for pupils at junior technical schools;
>
> establishment of useful contacts with industry in relation to the training of personnel;

securing valuable financial gifts for the award of scholarships and prizes for students, and administering the schemes;

obtaining facilities by way of part-time day release of workers for attendance at technical classes;

maintaining contacts with various government departments and other bodies such as the City and Guilds of London Institute, the regional examining unions, professional institutions, and the Industrial Association of Wales and Monmouthshire;

collecting statistics and giving publicity in the national press to many aspects of technical education;

providing a common meeting-ground for representatives of local education authorities, officials, the teaching profession, industrialists, trade unions and government departments.

The Advisory Council for Technical Education in North Wales

Although consideration had been given in the pre-war years to the setting up of a similar Council to represent the interest of North Wales, it was not until 1944 that the Advisory Council for Technical Education in North Wales was formed. This Council, in its brief period of existence, surveyed the educational needs of the various industries in the area and the facilities already provided to meet these demands. The information obtained, together with the Council's recommendations and suggestions for improving these facilities, was contained in a Report issued in 1947.

The Welsh Academic Board of Technology

In accordance with the general recommendations contained in the Lord Eustace Percy Committee's Report on Higher Technological Education issued in 1945, the Minister of Education suggested that the Advisory Councils for Technical Education in North and South Wales, and the University of Wales, should establish a Regional Academic Board to advise on the development and coordination of higher technological studies in the University and technical colleges of Wales. The Welsh Academic Board of Technology was consequently formed in 1946 and, at the inaugural meeting on 1st July 1946, it was decided to set up Academic Sub-Committees to consider the educational needs, at the higher levels, of the following industries:—engineering (mechanical, electrical and civil); chemical engineering and fuel technology; mining; metallurgy; building; commerce. The recommendations made by these Sub-Committees, many of which have since been implemented, were contained in the Report issued in 1948.

The Welsh Joint Education Committee

In 1946 a Working Party was appointed to consider the problems of Welsh educational administration and, in 1948, the Minister of Education accepted its recommendation that a Welsh Joint Education Committee be formed by an amalgamation of the Central Welsh Board (established in 1896), the Federation of Education Committees (Wales and Monmouthshire) and the Advisory Councils for Technical Education in North and South Wales. The Committee held its first meeting in Cardiff on 1st October 1948.

The functions originally delegated to the Advisory Councils for Technical Education in North and South Wales, and many of those carried out by the Welsh

Academic Board of Technology, were assumed by the Welsh Joint Education Committee under Section 12(i) of the Order made by the Minister of Education, sub-sections (c) and (d) of which read as follows:

> '12(i) The appointing Councils shall refer to the Joint Committee the following questions:
>
> (c) the provision of colleges of further education including in particular colleges of the arts and adult education;
>
> (d) the coordination of provision of further education.'

Although the Parliamentary Secretary to the Ministry of Education, in his Inaugural Address to the Welsh Joint Education Committee, said 'I am sure you would also wish me to give an assurance of the Minister's hope that the Welsh Academic Board of Technology will continue to be an effective link between the University of Wales and this Committee', this hope was not realised because the Board ceased to function, owing to lack of agreement concerning its constitution, soon after the establishment of the Welsh Joint Education Committee.

Post-War Expansion in Technical College Accommodation

During the 1930s extensions were carried out to the buildings at Cardiff and Swansea Technical Colleges and, at the outbreak of war in 1939, in addition to the five major colleges at Cardiff, Crumlin, Newport, Swansea and Treforest, there were 15 mining and technical institutes providing day and evening courses. The expansion of further education activities in the immediate post-war years resulted in acute accommodation problems and the technical colleges and institutions in Wales, as elsewhere, had to face the need for considerable additional accommodation. Owing to the national building problem it was not possible to embark on a programme of extension to technical education accommodation until 1949. Since that time, however, there has been a ceaseless drive to provide the facilities necessary to meet the ever-increasing demand for technical education in all its aspects. During the period 1949-58, 14 new colleges were built at a cost of £3,270,000 (excluding equipment) and a further £1,145,000 was spent on extensions to 13 existing establishments. In 1959 work was in progress on five further new colleges and extensions to four existing colleges. There were 45 major establishments for further education in existence during the session 1959-60 (see Appendix F).

Post-War Increase in the Teaching Staff at Establishments of Further Education

In addition to the accommodation and equipment provided to meet the increasing demand for technical education, suitably qualified teachers had to be recruited to staff the colleges. The following tables show the increase in the numbers of full-time and part-time teachers in major establishments of further education in Wales between 1947 and 1957:

Full-time Teachers

Year	Men	Women	Total
1947	179	26	205
1957	643	72	715

Part-time Teachers

Year	Men	Women	Total
1947	355	74	429
1957	1,122	252	1,374

Growth in the Volume of Work undertaken by Further Education Establishments in the Post-War Years

Major establishments for further education are defined by the Ministry of Education as those technical colleges and institutions which provide day and evening courses or day courses only. These are variously termed Colleges of Technology, Technical Colleges or Colleges of Further Education according to the standard and nature of the work carried out in them. The work is almost entirely vocational in character. Evening institutes provide evening classes which, in the main, are of a recreational or non-vocational nature; these are held in primary and secondary schools and also in Church, Chapel and Community Halls. In 1938 there were 885 evening institutes in Wales with 64,265 students. By 1958 these numbers had increased to 1,362 and 83,474 respectively.

The growth in the volume of work undertaken by the major establishments for further education in Wales during the period 1947-58 is shown by the student enrolment figures in the following table:

Year	No. of Ests.	Full-time Students		Part-time Day Students		Evening Students		*Total Students		*Total
		Male	Female	Male	Female	Male	Female	Male	Female	
1946-47	34	879	590	7,087	801	13,060	6,752	21,026	8,143	29,169
1947-48	37	1,011	592	8,351	1,011	16,476	9,625	25,838	11,228	37,066
1948-49	36	1,152	579	10,003	1,189	15,787	9,795	26,942	11,563	38,505
1949-50	38	1,108	655	10,625	1,607	16,921	9,804	25,122	11,793	36,915
1950-51	37	1,110	692	12,268	1,694	18,495	10,816	27,143	12,952	40,095
1951-52	39	955	695	13,791	1,536	18,442	8,826	27,207	10,768	37,975
1952-53	42	937	881	15,758	1,544	19,180	9,645	29,139	11,751	40,890
1953-54	43	797	1,126	16,952	1,599	21,148	9,718	30,982	12,015	42,997
1954-55	46	878	1,284	18,135	2,107	23,417	10,244	32,866	13,248	46,114
1955-56	45	1,058	1,550	19,189	2,442	23,919	11,687	34,777	15,092	49,869
1956-57	45	1,511	1,727	21,616	2,609	25,712	11,736	38,408	15,315	53,723
1957-58	46	1,960	1,853	21,920	2,630	25,431	10,271	38,603	14,004	52,607

* As from 1949-50, students attending during the day and during the evening in the same establishment are counted once only.

The total number of students attending grant-aided further education establishments, including major establishments, art establishments and evening institutes, in Wales during the session 1957-58 was 139,602. The corresponding total for the session 1937-38 was 67,089.

The decrease in the number of full-time male students attending the major establishments between 1950-51 and 1953-54 from 1,110 to 797 was probably due to such factors as the completion of courses by those ex-servicemen who had been in receipt of an award under the Further Education and Training Scheme, and the fact that the period was one of full employment resulting in more boys, on leaving school, entering industry rather than embarking on full-time courses at technical colleges. It is worth noting that there was an increase of 4,684 (38 per cent) in the number of part-time day male students in the same period. The establishment of full-time pre-apprenticeship courses at a number of technical colleges and the fact that during his first year the National Coal Board craft apprentice attends a technical college full-time, mainly account for the increase in the number of full-time male students over the period 1954-58. The growth in the number of full-time courses preparing girls for secretarial, pre-nursing and catering examinations resulted in the number of full-time female students being nearly doubled during the period 1953-58. The number of girls attending part-time day courses, although it more than trebled during the period 1946-58, is still disappointingly low. Many of the evening classes in major establishments, particularly those in women's subjects, are non-vocational and this fact probably accounts for the decrease in the number of evening students for the sessions 1951-52 and 1957-58 when fees for courses at further education establishments were increased.

Types of Courses

Day-release Courses

A feature of post-war technical education is the considerable increase in the number of students attending part-time day classes—a three-fold increase during the period 1947-58 as shown in the foregoing table. Statistics from 38 major technical institutes in Wales indicate that of those in attendance at part-time day classes during the session 1958-59, 94·4 per cent were day-release students, i.e. released from their employment, with pay, for one day a week to attend classes. Some industries, notably building, engineering and mining, are better than others in granting their apprentices this concession.

Sandwich Courses

Sandwich courses have been given considerable publicity during the last two or three years. Advanced courses leading to Higher National Diplomas and Diplomas in Technology are of this type. Although sandwich courses were established, as has been seen (page 9), at the School of Mines, Treforest, in 1913, and at Cardiff Technical College in 1919, the number of such courses in Wales is small and they are to be found mainly at the Welsh College of Advanced Technology and the Glamorgan College of Technology (see Appendices B and C).

Block-release Courses

A course of recent origin in Wales is the block-release type of course, which is usually concentrated into three full-time periods of one month each per year supplemented where possible by attendance at the college on one evening per week in the intervening periods. These courses extend over four or five years and during the session 1958-59 were operating at Llandaff, Newport and Newtown, but there are signs that they will develop on a wider scale in the near future.

Full-time Pre-Apprenticeship Courses

During the last four years a number of technical colleges have introduced a one-year full-time course for secondary school leavers. They are called Pre-

Apprenticeship Courses or Preliminary Engineering Courses and in nearly all cases they recruit almost entirely from secondary modern school leavers in the 15-16 years age-range. During the session 1958-59 there were eight such courses in existence. The curriculum varies from college to college, as also do the examinations taken at the conclusion of the course. The aim, generally, is to equip the student with the knowledge and practical training which will serve as an introduction to the industry which he will, it is hoped, enter later as an apprentice. The curriculum in most cases contains a considerable amount of technical work such as workshop practice, technical drawing, science and mathematics. The examination taken in some cases is an internal one, while in others external examinations, such as the Royal Society of Arts Technical Certificate or the General Certificate of Education Ordinary level in a few subjects, are taken. On successful completion of the course and obtaining apprenticeship, the better students may enter the first year of a National Certificate course, whilst the others enter a City and Guilds craft course or a Preliminary National Certificate course. Corresponding facilities are provided for girls at many technical colleges, with full-time courses, usually of two years' duration, in secretarial work and in preparation for careers in nursing and in catering.

Extended Courses at Secondary Schools

Some secondary schools, notably secondary modern schools, are developing special courses to meet the needs of the less academic pupils staying at school beyond the statutory age of 15. Some of these courses have a technical bias with a view to preparing boys for apprenticeships, others prepare girls for commercial, nursing or catering work, while others are more general in character. These courses usually lead to a school-leaving examination set by the local education authority or, in a minority of cases, to the General Certificate of Education Ordinary level examination. A survey made during the session 1958-59 showed that of the 224 secondary modern schools in Wales, about 40 conducted courses of this kind.

Post-War Developments in National Certificate and Diploma Courses

The number of students preparing for National Certificate examinations and the examinations of the City and Guilds of London Institute at the major establishments for further education in Wales has increased considerably during the post-war years. Since 1954 the Welsh Joint Education Committee has acted as Regional Examining Body for National Certificate examinations up to Ordinary National Certificate level. The numbers of students who were successful in gaining Ordinary National Certificates through examinations set by the Welsh Joint Education Committee in the years 1955 to 1959 were:

Year	Building	Chemistry	Commerce	Engineering		Metallurgy	Mining
				Electrical	Mechanical		
1955	17 (38)	24 (41)	6 (23)	48 (132)	86 (257)	11 (35)	96 (164)
1956	19 (46)	32 (54)	12 (29)	79 (128)	111 (286)	8 (34)	83 (154)
1957	33 (66)	32 (70)	15 (27)	82 (134)	171 (332)	6 (35)	121 (206)
1958	35 (72)	34 (61)	12 (28)	102 (186)	206 (437)	14 (37)	99 (210)
1959	71 (105)	74 (130)	25 (43)	161 (283)	374 (584)	36 (66)	178 (272)

(The figures in brackets indicate the total number of candidates.)

There has also been an increase in the number of colleges preparing students for the Ordinary National Certificate examinations of the Welsh Joint Education Committee between 1955 and 1959:

Year	Building	Chemistry	Commerce	Engineering		Metallurgy	Mining
				Electrical	Mechanical		
1955	4	4	4	6	6	5	7
1959	8	8	6	12	12	6	8

During the session 1958-59 three technical colleges in Wales were preparing students for Higher National Diplomas and ten for Higher National Certificates. The following tables, giving successes at Higher National Diploma and Certificate examinations for the three years 1950, 1955 and 1959, show a considerable increase in the number of Higher National Certificates in all subjects from 1950 to 1955 but marked changes only in chemistry and production engineering between 1955 and 1959.

Higher National Diplomas

Year	Building	Engineering		Mining
		Electrical	Mechanical	
1950	7 (15)	4 (10)	17 (23)	—
1955	11 (16)	—	9 (19)	14 (18)
1959	3 (5)	5 (6)	18 (19)	18 (18)

Higher National Certificates

Year	Applied Physics	Building	Engineering					Metallurgy	Mining	Chemistry
			Chemical	Civil	Electrical	Mechanical	Production			
1950	—	17 (19)	—	—	61 (77)	87 (122)	—	2 (2)	—	20 (25)
1955	—	29 (32)	10 (10)	—	108 (153)	139 (206)	11 (14)	16 (30)	33 (45)	48 (61)
1959	20 (25)	34 (41)	15 (15)	10 (11)	111 (187)	120 (175)	40 (50)	14 (26)	42 (60)	62 (79)

(The figures in brackets indicate the total number of candidates.)

Statistics relating to Courses in Building, Engineering and Mining

Courses in building, engineering (mechanical and electrical) and mining comprise the major part of the work of most of the technical colleges in Wales. The following table gives information relating to some of these courses for the session 1957-58:

Building

Course	No. of Colleges	No. of Students
Higher National Diploma	1	25
Higher National Certificate	5	101
Ordinary National Certificate (S.1, S.2 and S.3)	12	508
City and Guilds Courses:		
Brickwork	18	763
Plasterers' Work ...	9	210
Plumbers' Work ...	16	546
Gas Fitting	9	230
Carpentry and Joinery	21	1,446
Woodcutting Machinists' Work ...	4	147
Painters' and Decorators' Work	7	249

Mining

Course	No. of Colleges	No. of Students
National Diploma ...	1	44
Higher National Certificate	3	81
Ordinary National Certificate (S.1, S.2 and S.3)	7	795
(S.1 only)	9	276
Colliery Mechanics and Electricians Certificates:		
1st year (full-time) ...	9	361
Subsequent years (Mech.)	8	182
Subsequent years (Elec.)	6	178
Coal Mining Certificate ...	5	129
Potential Deputies' Course	10	413
Mining Trainees' Course (8 weeks full-time) ...	10	2,211

Mechanical Engineering

Course	No. of Colleges	No. of Students
Diploma in Technology...	1	42
Higher National Diploma	3	92
Higher National Certificate	9	523
Higher National Certificate (Production)	5	141
Ordinary National Certificate (S.2 and S.3) ...	15	1,747
(S.1, Mech. and Elec.)	31	1,711
City and Guilds Courses:		
Mechanical Engineering Craft Practice and Machine Shop Engineering	25	1,978
Welding	10	413
Sheet Metal Work ...	4	100
Motor Vehicle Craftsman's Certificate (1st, 2nd and 3rd year)	13	1,023
(1st year only)	3	52

Electrical Engineering

Course	No. of Colleges	No. of Students
Higher National Diploma	2	39
Higher National Certificate	7	383
Ordinary National Certificate (S.2 and S.3) ...	14	845
City and Guilds Courses:		
Electrical Installation ...	17	893
Electrical Technicians' Course	4	113

Technical State Scholarships

Technical state scholarships, tenable at universities or establishments for further education, are awarded annually to students who have attended establishments for further education and have satisfactorily completed a course leading to an Ordinary

National Diploma or Ordinary National Certificate or, by part-time study, a course of equivalent standard. The recipient of a scholarship pursues a course, approved by the Minister of Education, which normally leads to an Honours degree or to a Diploma in Technology, but in special circumstances may lead to other qualifications of a requisite standard.

The numbers of these scholarships awarded to students from establishments for further education in Wales in each of the years 1955 to 1959 were 8, 12, 14, 15 and 18 respectively. During the session 1958-59, 51 technical state scholars were attending colleges of the University of Wales and a further 5 were at other establishments in Wales.

Grading of Technical Colleges

In Circular 305, issued on 21st June 1956, the Ministry of Education outlined a scheme for grading technical colleges, according to the standard of work carried out, into four types—Local, Area, Regional and Colleges of Advanced Technology.

Local Colleges satisfy local needs, and on the vocational side provide courses, mainly part-time, up to Ordinary National Certificate, intermediate and, in some cases, final examinations of the City and Guilds, and intermediate professional examinations. Full-time '15+' courses—pre-apprenticeship for boys, pre-nursing and pre-catering for girls—are being developed at many local colleges. The majority of these colleges are termed Colleges of Further Education.

Area Colleges, in addition to providing some of the facilities found in local colleges, serve the needs of an area for more advanced courses such as Higher National Certificate and final City and Guilds courses. Some, if the demand justifies, conduct sandwich courses leading to Higher National Diplomas.

Regional Colleges, as the name implies, serve a wide area. The major part of their work is with advanced courses—Higher National Diplomas, Higher National Certificates and courses of a similar standard—concerned with the training of high grade technicians and technologists. At present the only technical college in Wales given this status is the Glamorgan College of Technology at Treforest.

Colleges of Advanced Technology form the pinnacle of this pyramidal structure for technical colleges. They provide courses exclusively of an advanced character normally requiring entry qualifications of Ordinary National Certificate or Advanced level of the General Certificate of Education standard. The courses, in the main, are full-time or sandwich and are concerned with training technologists. At these colleges, generally, will be held courses for the Diploma in Technology which is equivalent in standard to an honours degree of a British university and is awarded by the National Council for Technological Awards set up by the Minister of Education in 1955. These colleges, conducting courses of undergraduate and postgraduate standard, must satisfy certain conditions in respect of accommodation, staff and governing body. Wales has one college of advanced technology—the Welsh College of Advanced Technology at Cardiff.

In formulating the above scheme for the grading of technical colleges the Ministry's object was to provide a framework, based on the structure then existing, which could be modified and expanded to meet future demands. When circumstances justify, a college may be promoted to a higher grade, and colleges therefore are encouraged to expand the volume and raise the standard of their work. The

Circular stressed the need for full understanding and cooperation between local education authorities to promote regional coordination, which is essential to the success of the scheme.

The Welsh College of Advanced Technology

The College of Technology and Commerce, Cardiff, was designated a College of Advanced Technology in March 1957 and was re-named the Welsh College of Advanced Technology. Since that date, courses which were deemed to be of a lower standard than that appropriate to a college of advanced technology have been transferred to Llandaff Technical College and the College of Art, Cardiff, and the Department of Bakery and Catering has been withdrawn from the College and set up as a separate establishment. Student enrolments in the various Departments of the Welsh College of Advanced Technology during the session 1958-59 were:

Department	Full-time	Sandwich	Part-time day and evening
Architecture	134	—	16
Building	5	25	184
Chemistry	4	3	191
Commerce	130	—	1,563
Electrical Engineering	—	22	134
English	30	—	451
Mathematics	—	—	234
Mechanical Engineering ...	71	66	122
Navigation	177	—	6
Pharmacy	102	—	—
Physics	50	—	30
Totals	703	116	2,931

Total: 3,750

The enrolments at the College in 1956-57, its last session as a College of Technology and Commerce, were:

Full-time	*Part-time*	*Total*
1,265	5,282	6,547

The shedding of junior level work has therefore meant a reduction of 35 per cent in the number of full-time students and 45 per cent in the number of part-time students during the period 1957-59.

Since its designation as a College of Advanced Technology, the College has been authorised by the National Council for Technological Awards to conduct sandwich courses for the Diploma in Technology in mechanical engineering (September 1956), in electrical engineering (September 1958) and in applied physics (September 1958). Two others are under consideration—production engineering and statistics. The Higher National Diploma courses conducted at the College during the session 1958-59 were in building, electrical engineering and mechanical engineering. Approval was granted to commence a Higher National Diploma course in chemistry in the session 1959-60.

Recruitment to Advanced Sandwich Courses

Recruitment to advanced sandwich courses at the Welsh College of Advanced Technology and the Glamorgan College of Technology (see Appendices B and C) is largely from grammar school leavers who have passed in the appropriate subjects at the General Certificate of Education Advanced level examination. Some of these are already in industry and are released to attend college for six months each year (works-based) while others enter college direct from school and the college 'places' them in industry for the industrial training periods (college-based). In general the works-based student is paid his wages during the time he attends college, but if not he and his college-based counterpart can apply to their local education authorities for an award to cover the periods when they attend college (see the Ministry's Administrative Memorandum No. 567 issued 22nd April 1958). At the Welsh College of Advanced Technology, of the 71 students released with pay from industry to attend the six-monthly periods at college, 27 are from nationalised industries and 44 from private firms. At the Glamorgan College of Technology the numbers are 88 and 22 respectively.

Recruitment to Diploma in Technology courses of students with Ordinary National Certificate qualifications has so far been very disappointing. Reference to Appendix A shows that of 33 students from technical colleges in Wales who as the result of the 1958 Ordinary National Certificate examinations gained the necessary admission qualification to a Diploma in Technology course in electrical engineering, none enrolled for the course at the Welsh College of Advanced Technology in September 1958. Similarly, of 69 students who gained the necessary admission qualification to a Diploma in Technology course in mechanical engineering, only three enrolled for the course in September 1958. No students, either with Ordinary National Certificate qualifications or with appropriate General Certificate of Education Advanced level passes, enrolled for the Diploma in Technology course in applied physics in September 1958 at the Welsh College of Advanced Technology.

Enrolment of students with Ordinary National Certificate qualifications to Higher National Diploma courses in mechanical and electrical engineering in Wales has been equally disappointing. Of 97 students qualified to do so in electrical engineering as the result of the 1958 Ordinary National Certificate examination, only one enrolled for the Higher National Diploma in Electrical Engineering in September 1958. In mechanical engineering only three such students enrolled out of 146 with qualifications to do so.

Expansion in University Provision

To meet the increasing demand for scientists and technologists, great strides have been made in recent years in providing the facilities necessary to train those who are deemed suitable and capable of attaining high and specialist qualifications in the fields of science and technology. The report issued by the Scientific Manpower Committee of the Advisory Council on Scientific Policy in 1956 suggested that 'the number of people qualifying each year in science and engineering would need to increase from about 10,000 in 1954-55 to about 20,000 in 1970 . . . if the necessary economy is to grow at an acceptable rate'. The 'qualification' assumed by the Committee in its report was a university degree in science or engineering, or its equivalent.

Considerable expansion has taken place in the universities since the war. The

Barlow Committee, appointed in 1945, in considering the question of scientific manpower, recommended that the output of science graduates should be doubled at the earliest possible moment. The universities took only four years to implement this recommendation. In its report of 1952, however, the Scientific Manpower Committee stated that in spite of the post-war expansion that had already occurred in the universities the shortage of practically all kinds of trained scientists and engineers was likely to be an enduring one. Plans were then made to strengthen the engineering and science departments in a number of universities and expansion in this direction is continuing at present.

University of Wales

During the course of our enquiry we were made aware of the ambitious programme of expansion now being carried out in the pure and applied science faculties of the University of Wales and met a number of heads of departments. This is not the place to review or to assess what is being done and we confine ourselves to a brief comment. There have been striking developments. New buildings have been completed, work is in progress on others and still further extensions are envisaged for the future. These buildings will increase considerably the capacity of the University for graduate and postgraduate training in science and technology.

The numbers of students in the various departments have increased considerably although the number of outstanding students tends to remain the same. This is to be expected since even before the war the latter would have obtained university scholarships of one sort or another. Most of the departmental heads agreed that there was a place at the University for the good average student, namely the student capable of taking a good pass degree. Some were of the opinion that such a course was within the capacity of more sixth form pupils than now came forward. On the other hand, others were of the opinion that the number of applicants for admission to a degree course who had qualifications that could be considered satisfactory (rather than the minimum necessary) was hardly in excess of the number of places available. Some departments expressed satisfaction with the quality of the students in their honours classes but agreed that no great increase in numbers in this particular category could be expected, and that there is a tendency for outstanding students to continue to go from Wales to the older universities.

There is close cooperation between schools and the University which is advantageous to all, especially the pupils, and the Council is pleased to note the number of conferences held to promote this cooperation.

Any increase in the number of average students entering the University tends to raise the failure rate in university examinations compared with pre-war days. Heads of departments were concerned about this aspect of the expansion and the matter is being carefully watched by them. There was general agreement that the content of the General Certificate of Education Advanced level syllabus might with advantage be reduced in a number of the sciences in such a way as to make a higher intellectual demand of the sixth form pupil and less exercise in mere use of memory.

It should be noted that students who graduate in the pure sciences may, if they so wish, transfer to applied science departments for further training and research. This is a method of embarking on a career as an industrial scientist which might well expand in the future. Personal contact is maintained between individual departments and industry, and the students are given every opportunity of gaining appropriate industrial experience during their university careers. For many, such experience forms an essential part of their course.

It is to the universities that schools and technical colleges naturally look for a continuing supply of well-qualified teachers. The shortage of mathematics and science teachers is already affecting the quality of students entering universities and the quality, in turn, of scientists recruited by industry. The gravity of the situation cannot be over-emphasised and the problem should be tackled ruthlessly and with imagination if standards are not to fall lower. The position has been aptly described as 'eating our seed potatoes'.

Statistics relating to Courses in Science and Applied Science in the Colleges of the University of Wales

Some statistics relating to full-time students pursuing graduate and postgraduate courses at the constituent Colleges of the University of Wales from 1937-38 to 1957-58 are given in Appendix D. An initial decrease in the numbers, reaching a minimum during the war period then increasing to a peak in the period 1948-50 due to the return of ex-servicemen, followed by a decline until 1953-55 and a steady increase again in the period 1955-58, is the pattern followed by both arts and science students on graduate courses. The numbers pursuing applied science courses, however, continued to increase from 1937 to 1942; there was then a slight decrease for the next two years, after which they increased to a peak in 1948-49, decreased again until 1953-54, since when there has been a considerable increase.

Compared with those in the session 1937-38, the numbers pursuing graduate courses in the session 1957-58 had increased by the following proportions:

> Arts courses—49 per cent; Science courses—163 per cent; Applied science courses—316 per cent.

For the session 1957-58 the numbers of students pursuing graduate and postgraduate degree courses in arts, science and applied science, as proportions of the whole student body, were as follows:

University	Proportion of student body pursuing graduate and postgraduate courses in arts	Proportion of student body pursuing graduate and postgraduate courses in science	Proportion of student body pursuing graduate and postgraduate courses in applied science
University of Wales	37 per cent	30 per cent	12 per cent
All British Universities... ...	42 per cent	22 per cent	14·7 per cent

The growth in the number graduating in science and applied science in the University of Wales during the period 1938-58 is shown in the following table:

Year	Number who qualified for initial degrees in science and in applied science	Number who graduated with Honours in science	Number who graduated with Honours in applied science
1937-38 ...	230	125	10
1947-48 ...	462	160	76
1957-58 ...	493	203	64

The University of Wales is one of the very few universities that admit students with National Certificate qualifications in lieu of normal matriculation requirements and, in consequence, applications for admission, particularly to the engineering departments, are received from all over Britain. Evidence from these departments indicates that the best among these students compare favourably in progress and attainment with those who enter direct from grammar schools. Out of 12 first-class honours degrees awarded by the engineering department of one of the colleges during recent years, 5 were gained by students recruited from technical colleges, with National Certificate qualifications. Similarly, at another college 3 out of 5 first-class honours degrees in engineering recently awarded were gained by students of this type. The Council notes with pleasure the success of these students and hopes that both industry and University will continue to encourage admissions by virtue of National Certificate qualifications.

Women and Girls attending Technical College Courses

The number of women and girls that pursue courses at major technical establishments in Wales has increased considerably during the period 1948-58. Reference to the Table on page 12 shows that the number in full-time attendance has increased from 592 to 1,853, the number attending part-time day classes from 1,011 to 2,630 and the number at evening classes from 9,625 to 10,271. Of the 4,483 in attendance at full-time and part-time day classes during the session 1957-58, 3,196 were pursuing courses relating to specific occupations 1,681 full-time and 1,515 part-time. The two largest sections of the 1,681 full-time students were those pursuing commercial courses (1,175—70 per cent) and medical auxiliary courses (257—15 per cent). The three major contributors to the 1,515 part-time students were commerce (565—37 per cent), domestic subjects (466 31 per cent) and chemistry (126—8 per cent). There is every indication that the number of girls attending full-time courses will continue to increase with the development of recently established courses in pre-nursing and catering and with the increasing demand for commercial training.

An analysis of the number of women students attending National Certificate and comparable courses in technology at the major technical establishments in

Wales during the session 1957-58 together with the occupations of some of them are given in the following tables:

Course	Number of Women Students
B.Sc. (General)	2
O.N.C. Chemistry	85
H.N.C. Chemistry	5
A.R.I.C.	14
O.N.C. Applied Physics	7
O.N.C. Mechanical Engineering	40
H.N.C. Mechanical Engineering	1
O.N.C. Electrical Engineering	3
O.N.C. Metallurgy	4
O.N.C. Building	5
O.N.C. Textiles	9
Medical Laboratory Technicians	52
Line Tracers	5
Laboratory Technicians	8
Television Servicing	1
Plastics Technology	1
Radiography	19
Pharmacy	1
Diploma in Electrical Engineering	1
Total	263

Occupation	Number
Laboratory Technician	181
Radiographer	19
Draughtswoman	17
Tracer	16
Drawing Office Assistant	4
Technician (Elec. Eng.)	3
Assistant Engineer (Elec.)	2
Apprentice (Elec. Eng.)	2
Junior Quantity Surveyor	2
Scientific Officer (National Coal Board)	2
Apprentice (Radio Eng.)	1
Computer	1
Total	250

Commercial Education

Training in some commercial subjects, such as shorthand, typewriting and general secretarial work, is given at most technical colleges; an increasing amount of this junior work is done in full-time courses by school leavers, in the age-range 15-17 years, prior to seeking employment, but by far the greater proportion is carried out in evening classes. Release from employment to attend day classes for this training is on a very small scale.

More advanced courses, as for example those in preparation for National Certificates in Commerce, Diploma in Management Studies, and for examinations of professional institutions such as the Chartered Institute of Secretaries, the Institute of Bankers, and the Association of Certified and Corporate Accountants, are held only in few technical colleges. The greater proportion of this work, again, is carried out in evening classes and only recently, during the last three or four years, when technical college principals and heads of departments have made a determined effort to enlist the sympathetic cooperation of the firms concerned, has there been any significant tendency to release employees to attend day classes. The Advisory Committee on Further Education for Commerce in its recent Report (February 1959) urges commercial firms in Britain to release their employees for day-time study on a greater scale than is done at present and suggests that the present number of students (about 20,000) released in the day-time for commercial studies at intermediate level and above be increased to 50,000 by 1964 at the latest, and we are in general agreement with this view.

Junior Technical Schools and Secondary Technical Schools

The schools established under the Intermediate Education Act of 1889 had the word 'Technical' in their title, but in practice this aspect of their work tended to be neglected. It was in 1916 that the first junior technical school in Wales was opened at Newport and established in the Newport Technical College. In the following year a junior technical school in the Cardiff Technical College was recognised by the Board of Education; this had been in existence in another form for some years previously. The technical bias of these schools was towards the engineering, building and allied trades. In 1918 a junior nautical technical school was opened at Newport and in 1921, through the generosity of Sir William Reardon Smith and others, a similar school was opened at Cardiff Technical College when 22 boys were admitted. The number of boys attending these four schools in the session 1922-23 was 200, made up as follows:

Cardiff Junior Technical School...	44
Smith Junior Nautical School	53
Newport Junior Technical School	64
Newport Junior Nautical Technical School ...	39

In 1924 a junior technical school was opened at Pentre, Rhondda, with an enrolment of 90 boys. In the same year the Newport Junior Nautical Technical School was closed. Two further junior technical schools were recognised by the Board of Education in 1926. These were commercial schools at Cardiff Technical College and Newport Technical College. The number on roll at the six junior technical schools during the session 1927-28 was 659.

In the period 1929-37 a further 14 junior technical schools were opened, mainly in the newly built mining and technical institutes that were being erected in various areas by local education authorities with aid from the Miners' Welfare Fund (see Appendix E). The junior technical schools (engineering and commerce) at Cardiff Technical College were closed in 1931 and the pupils formed the nucleus of the new Cathays Secondary Schools where the curricula were so designed as to cater for their special needs. During the session 1937-38 there were 1,521 in attendance at the 18 junior technical schools in Wales.

Following the 1944 Education Act junior technical schools were re-named Secondary Technical Schools. The number of these schools continued to grow in the period 1937-47 and in 1947 there were 24 in Wales—19 for boys (with 2,295 on roll), 1 for girls (with 99 on roll) and 4 mixed (with 679 boys and 277 girls on roll) —with a total of 3,350 on roll. Since that date two others have been opened and eleven closed. It seems likely that within the next five years a further six to ten will be closed. In nearly all cases these closures result in the grammar and modern secondary schools of the particular areas concerned becoming bilateral grammar-technical and modern-technical schools.

Admission to all but four of the present secondary technical schools is at 13 years and selection is by means of a written examination. In Cardiff, Newtown and Swansea admission to these schools is at 11 years and selection is made on the results of the '11+' examination. A large number of pupils naturally leave at the age of 15 but those who wish to prepare for examinations stay until they are 16 years or older. Secondary Technical Certificate examinations are set in engineering, building, science and commerce. These are internal examinations with external assessment, and possession of a certificate can, under certain circumstances, exempt its holder from the S.1 National Certificate examination in that subject.

Statistics relating to the Secondary Technical Certificate examinations for 1959 are given in the following table:

Certificate	Entries	Passes	Percentage Passes
Engineering	305	169	55·0
Building	16	12	75·0
Commerce	6	2	33·3
Science	32	21	65·6

A few of the secondary technical schools prepare some of the more able pupils for the General Certificate of Education Ordinary level examinations and in four schools even to Advanced level. A pupil from one of these schools was recently awarded a state scholarship. A number of pupils who have gained creditable success at the General Certificate of Education Ordinary level examinations have been transferred to grammar schools to prepare for the Advanced level examinations.

The trend towards bilateral grammar-technical schools will result in pupils in the technical streams being prepared normally for the General Certificate of Education Ordinary level examination, in which case the Secondary Technical Certificate will be less generally used. Side by side with this development there will be an increasing number of modified syllabuses in various subjects, for the General Certificate of Education Ordinary level examination, giving them a more practical bias.

CHAPTER II

The Industrial Background

Early Developments in Iron, Tinplate and Coal

Prior to the middle of the eighteenth century there was little large-scale industrial activity in Wales. The demand for iron in the second half of that century brought English ironmasters to the upper parts of the valleys in South-East Wales where ironstone, limestone, wood and water were found together with a plentiful supply of coal. From here iron production spread to other areas in South Wales and early in the nineteenth century this region was among the greatest iron-producing centres in the world.

The trend to replace wrought and cast iron by steel, which began towards the middle of the nineteenth century, led to the closure of many of the early iron-works which could not be adapted to the new methods. Opportunities of employment in the iron industry therefore diminished but new opportunities soon appeared in the rapidly developing coal industry. The making of tinplate, which had centred mainly in the Pontypool area following Hanbury's invention of new rolling methods in 1720, had, by the beginning of the nineteenth century, been established at Cardiff, Newport, Forest of Dean and in West Wales.

There were similar developments in the coal industry, particularly when the use of coke replaced that of timber for the smelting of iron. The coal, steel and tinplate industries attracted many from the nearby agricultural counties of Wales and from South-West England, and, by the early years of the second decade of the present century, South Wales had a large industrial population mainly dependent for employment on the production and transport of coal, steel and tinplate.

Industrial Depression

There was a high demand for coal and steel throughout the first World War and consequently these industries flourished in South Wales as elsewhere.

The early 1920s saw a serious decline in the export trade, particularly in coal, which resulted in large-scale unemployment in South Wales. In 1923 about 52 out of every 100 insured workers in South Wales were employed in the coal-mining industry; by 1935 this number had fallen to 37. During the inter-war years South Wales experienced an unemployment rate which was twice that of Britain as a whole; 3 out of every 10 insured workers were unemployed. The unemployment rate in some of the coal-mining districts rose above 50 per cent.

Some of the more prosperous areas in England, particularly those in the Midlands and the London area, attracted large numbers of Welshmen and their families during the 'twenties and the 'thirties. It is estimated that about 400,000 left South Wales between 1921 and 1938.

This industrial depression led to what may be termed the Second Industrial Revolution. Dependence on a few heavy industries for economic existence was primarily responsible for the depression; a solution to the problem therefore and a safeguard against the recurrence of such depressions was the establishment of new and varied industries in the area. This was made clear in an industrial survey carried out by the University College of South Wales and Monmouthshire in 1931.

Special Areas Act

In 1934 South Wales, among other Depressed Areas in Britain, became the responsibility of a Commissioner for Special Areas, charged with the task of initiating and organising 'measures designed to facilitate the economic development and social improvement' of these areas with the aid of a fund provided under the Special Areas Act. One result of the Commissioner's activities was the establishment of an industrial estate at Treforest, about seven miles from Cardiff. Modern factories were built on this site for letting to industrialists whose limited capital made private building difficult. Work began on the estate construction at the end of 1936 and the first factories were occupied in mid-1937. By 1939 over fifty firms had settled in factories on the estate, many of them continental industrialists who had been forced to leave their own countries to escape persecution. These firms introduced new processes and products and trained their workers, numbering about 2,000, in new skills and techniques.

In addition to the development at Treforest, individual factories were opened at Dowlais, Treorchy, Llantarnam, Cwmbran, Pontypool, Caerphilly and Aberdare, their products ranging from silk stockings and wooden buttons to plate glass and cables. Industrial progress in North Wales during this time was limited to Deeside where the textile industry expanded with the growing popularity of rayon, and steel sheet production increased to match even that of the giant new plant at Ebbw Vale in South Wales.

War-time Recovery

At the outbreak of the second World War there were more than 100,000 people in Wales unemployed—15 per cent of the insured population. The war, however, accelerated economic recovery. The demand for coal and steel revived, Royal Ordnance Factories were set up and many industries were transferred from vulnerable areas. By 1943, when war production reached its peak, at least 130,000 Welsh men and women were at work in their native land in entirely new undertakings connected with the war, and unemployment had virtually disappeared for the first time in a quarter of a century.

Post-War Developments under the Distribution of Industry Act

When hostilities ceased in 1945, much of the work which had been developed during the war years disappeared and unemployment again appeared in 1946. The Distribution of Industry Act of 1945 replaced the Special Areas legislation, and the Board of Trade was given the task of supervising industrial reconstruction. Areas in which there was a likelihood of considerable unemployment were scheduled as Development Areas and, under the Act, the Board of Trade and other government departments concerned were empowered to build factories in these areas which could be rented to industrialists on advantageous terms. Steps were also taken to restrict the continued growth of new industry in the more congested areas such as London and the Midlands; new buildings were subject to licence up to 1953, and licences were granted more freely in Development Areas than in the congested areas. Industrialists proposing to undertake factory building were required to notify the Board of Trade of their plans and by this means the Board was given the opportunity of bringing to each industrialist's notice the claims and the advantages of the Development Areas.

Two of the largest Royal Ordnance Factories in Wales, those at Bridgend and Hirwaun, were converted into industrial estates. A smaller one at Wrexham was similarly converted and a new industrial estate was constructed at Fforestfach, near Swansea. Many smaller Government war-time establishments were allocated to individual industrialists and these measures, together with the building of new factories with Government finance on individual sites, went a long way towards making good the shortage of industrial premises and to reducing the unemployment rate to a low figure by the early 1950s.

The Wales and Monmouthshire Industrial Estates Ltd., founded in 1936 under the Commissioner for Special Areas, and through the Distribution of Industry Act of 1945 appointed an Agent of the Board of Trade, had by 1959 constructed or adapted 13,838,723 square feet of factory space. The 343 industrial tenants housed in these factories employ about 61,000 persons. A further 932,000 square feet of extensions were in course of construction in July 1959.

In addition to creating opportunities for employment in new and varied types of manufacturing industries, the post-war period has seen great developments in the old-established coal, steel and tinplate industries.

Post-War Developments in the Coal-mining Industry

The coal-mining industry, expanding from the middle of the nineteenth century, reached its peak in Wales in 1913. At that time, with a labour force of 275,000 in the South Wales coalfields, annual production was about 57 million tons, of which nearly 35 million tons were exported. By 1946 the labour force had fallen to about 100,000 and production to 20 million tons a year; the export trade had all but disappeared. The industry was nationalised in 1947 and the National Coal Board's 'Plan for Coal,' published in 1950, outlined a programme covering the 15-year period to 1965 for the reconstruction of the industry. In 1956 the situation nationally was reviewed in another publication—'Investing in Coal'—in which it was indicated that in the period to 1965 the National Coal Board proposed an expenditure of £1,000,000,000 in carrying out the reconstruction of British coalmines. A tenth of this was apportioned to the South Wales coalfield, an amount higher than for any other coalfield in Britain.

In the development now under way over 70 mines in South Wales, deemed to have passed the limits of economic working, have been closed. New pits have been developed and others modernised with horizon mining and other modern techniques; increased mechanisation has been introduced to improve the efficiency of mining the coal and of transporting it; manpower has been concentrated at the best points of production so as to secure best returns from men and machines; schemes for the recruitment and training of youth have been introduced to offset the wastage in a coalfield where for many years most of the manpower has been in the older age groups. By 1965 it is planned to raise the output from the South Wales coalfield to 26 million tons a year. In 1958 its output was 23,280,000 tons while that of the North Wales coalfield was 2,470,000 tons; the estimated number of insured employees in the two coalfields was 119,550, a reduction of 14,580 since 1948.

Steel and Tinplate Production in the Post-War Years

Steel and tinplate production methods have been revolutionised in the post-war years by the adoption of continuous strip mills and cold teduction plants. One of the biggest single post-war industrial projects in Europe has been the construction of the great steel and tinplate plants by the Steel Company of Wales at Margam (Port Talbot), Trostre (Llanelly) and Velindre (near Swansea). At the steel centres of Ebbw Vale, Dowlais, Cardiff, Newport and the Deeside, modernisation projects are in hand or have been completed. The number of employees in the iron and steel industry (excluding tinplate manufacture) in Wales in 1958 was 59,626, an increase of 32·4 per cent over the number employed in 1948. Production of iron and steel (excluding tinplate) in 1958 was 9,111,041 tons, an increase of 83·6 per cent over that in 1948. In 1958 steel sheet production in Wales was 89 per cent of Britain's total production, steel plate 21 per cent and crude steels 29 per cent.

The inter-wat years marked a significant change in the nature of the tinplate industry whereby numbers of small companies, which operated on an independent basis, became integrated. In 1938 Britain's first wide strip mill came into production at Ebbw Vale and this, together with cold reduction mills for the production of sheets and tinplates, marked the beginning of the end of the old traditional methods of tinplate manufacture. The old hand-mills have virtually disappeared during the last few years with the installation of vast new plants at Margam, Trostre and Velindre and with extensions to other plants. The new methods employed in tinplate manufacture have increased production considerably with a reduced labour force. In the period 1948-58 production of tinplate increased by 44·8 per cent to 1,036,200 tons a year, while the number employed in the industry fell by 41·5 per cent to 9,910. Wales produced 99 per cent of Britain's tinplate output in 1958.

Aluminium and Light Alloy Manufacture

Aluminium smelting and aluminium sheet production were commenced in Wales in 1908 at Dolgarrog, near Conway, soon after Britain's first aluminium smelter had been built in Scotland. The next developments were in South Wales just prior to the second World War, when the demand for aluminium commodities was beginning to grow. Production increased considerably during the war with the increasing demand for aluminium and its alloys in the construction of aircraft and other military equipment. By the end of the war six aluminium works had been established in South Wales. These have since been extended and are now among the most flourishing in Britain. The demand for aluminium and its alloys has continued to increase during the post-war years; during the period 1948-58 the output from the aluminium works in Wales increased by 63 per cent to 86,787 tons, which was about 40 per cent of Britain's total output for 1958.

Engineering

Considerable expansion has taken place during the post-war years in light engineering industries including electrical engineering. Several new factories have been opened in Wales for the manufacture of domestic appliances and others are now under construction. One electrical manufacturing firm which, when it opened in South Wales in 1941, employed 30 people now employs 1,800 and has an intake of 80 apprentices a year; two firms, manufacturing certain domestic appliances, that became established in Wales soon after the war now employ 3,500 between them. An important development in North-East Wales during the post-war years has been in aircraft manufacture. This commenced in 1948 with a labour force of 120 and expanded at such a rate that it now employs over 5,000.

The Chemical and Allied Industries

The growth of the chemical and allied industries in Wales during the past 20 years has been a spectacular one. In 1937 they had a labour force of well under 10,000. By 1948 this had risen to 19,700 and in 1958 it was 25,110. The manufacture of chemicals has been established in Wales for almost a century but it is only in recent years that such activity has developed from isolated and small-scale enterprises into an important and flourishing industry. In addition to the extension and modernisation of pre-war premises and plants several new plants have been built in the post-war period. One of these, occupying a site of about 100 acres in Barry, Glamorgan, is one of the largest plastic raw materials factories in Britain. With chemical processes becoming basic to almost every kind of industrial activity, it seems likely that the chemical industry will give a steadily growing stability to the industrial structure of Wales.

Oil refining at Llandarcy, near Neath, was commenced in 1922, the refinery being the first large-scale one in Britain for the treatment of crude oil. In the early 1920s the refinery operated partly on crude oil and partly on semi-refined oil shipped from Persia for re-distillation into the white products such as motor spirit and kerosene. Later, plants producing more and better quality motor spirit were installed together with plant for the production of high quality lubricating oils. At the outbreak of the second World War the capacity of the refinery was about 360,000 tons a year. After the war, to provide for an expanding home market, it was decided to instal further plant and raise the input to the refinery to 2,500,000 tons a year, but, owing to the rising demand for oil, the capacity has been stepped up to 3,000,000 tons. The refinery now employs 2,500 as compared with 1,000 at the outbreak of war. Further developments now under way for oil refining and for storage facilities at Milford Haven will expand still further the capacity and labour force of this industry.

The Textile Industry

The textile industry, now employing 1·7 per cent of Wales' labour force, has experienced as revolutionary a change as any industry over the past 20 years, with the development of a variety of synthetic fibres. In 1958, of the 16,290 persons employed in the textile industry in Wales 11,500, i.e. 70 per cent, were concerned with the manufacture of yarn or cloth in synthetic materials whereas the woollen industry accounted for only 730. This fact illustrates the change-over and the expansion which has taken place in the textile industry, an expansion which has taken up at least 4,500,000 square feet of factory floor space in Wales in the post-war period.

Changes in the last Twenty Years

The changing pattern of industry in Wales during the past 20 years has resulted in a steady decrease in the proportion of the insured population employed in the heavy industries such as coal-mining and iron and steel production and a corresponding increase in the proportion employed in the manufacturing industries. Reference to Appendix G, in which estimated numbers of insured employees in the various industrial categories during 1948 and 1958, in Wales, are given, indicates the changes that have occurred in the industrial pattern of Wales during the post-war years. In addition to the increases already mentioned in the numbers employed in chemical and allied industries and the textile industry, other examples of increases during this ten-year period are:

> Constructional engineering, 96 per cent; radio and television receiver production, 162 per cent; manufacture and repair of watches and clocks, 128 per cent; rubber manufacture, 579 per cent; electricity supply, 70 per cent; motor repairs and garages, 38 per cent; paper manufacture, 47 per cent; distributive trades, 13 per cent; professional services, 31 per cent.

Before the second World War about 40 per cent of the insured population in Wales earned their living in the heavy industries while the manufacturing industries employed about 12 per cent. By 1948 these proportions had changed to 22 per cent and 20 per cent, and by 1958 to 21 per cent and 24 per cent respectively. That is, whereas in pre-war years three persons were employed in the heavy industries to every one in the manufacturing industries, the number employed in the manufacturing industries in 1958 exceeded that in the heavy industries. This expansion of the manufacturing industries, in which nearly one in every four workers in Wales is now engaged, is an indication of the success of the Special Areas and Development Areas policies.

Industries in Wales which have experienced reduction in employment in the post-war years are those of building and contracting, slate-quarrying and dock traffic. In building and contracting, the number employed in 1938 was 79,480. This decreased to 66,030 by 1948 and again to 62,060 in 1958. In the slate industry the numbers employed during these three years were 8,490, 4,680 and 3,330, and the output of slate was 219,000 tons, 106,000 tons and 69,000 tons respectively. The quantity of goods handled at the principal ports in Wales in 1938 was 24,790,000 tons. This had decreased to 13,461,000 tons by 1948, but due mainly to additional traffic at Swansea Docks the amount handled in 1958 increased to 16,934,000 tons. It is of interest to note that the amount of coal loaded at these ports during each of the above-mentioned three years was 19,433,000 tons, 6,752,000 tons and 3,444,000 tons respectively, whereas the amount of oil discharged was 524,000 tons, 1,241,000 tons and 3,830,000 tons. The amount of oil now handled by the Welsh ports exceeds that of coal.

The Contribution of Women to Industry

A significant contribution has been made by the women of Wales to the industrial expansion which has taken place during the past 20 years. The peak of the war effort brought a 125 per cent increase in the number of women at work in industry in Wales (30 per cent in Britain as a whole) compared with the number so employed in pre-war days. The creation during war-time of hitherto unknown employment opportunities for women has provided in post-war years a labour force far exceeding that of pre-war years. Whereas in 1937 out of every 17 insured employees in Wales only 2 were women, in 1958 there were 2 in every 7. It is significant that for the period 1948 to 1958 a total increase of 32,470 in the number of insured employees in Wales was a result of an increase of 34,250 female and a decrease of 1,780 male employees. There were 269,000 women in insured employment in Wales in 1958 out of a total insured population of 952,000. Their distribution among the major employment groups was as follows, the percentage figures in each case representing the female proportion of the group:

> manufacturing industries, 70,000 (31 per cent); miscellaneous services, 51,600 (76 per cent); distributive trades, 50,400 (54 per cent); professional services, 50,000 (66 per cent); national and local government, 16,400 (25 per cent).

Although the number of women and girls in employment has shown this marked increase in the past 20 years, industry is reluctant to offer girls the opportunities and prospects that boys enjoy in skilled trades as craftsmen or technicians or as technologists. The chemical and allied industries, for example, recruit girls with suitable qualifications as laboratory technicians or as assistants in research laboratories, but there is little prospect of their progressing to assume posts of responsibility in a supervisory or managerial capacity. In the engineering industry a few girls are recruited as draughtswomen or tracers. Very little consideration seems to have been given to the possibility of recruiting girls with the intention of preparing them for professional qualifications within the engineering industry.

At a time when great publicity is given to the serious shortage of people with scientific and technological qualifications needed to meet the requirements of Britain's rapidly expanding industries and government scientific services, should not greater attention be paid to the reserve of undeveloped scientific and technological talent among girls? Although some employers are prepared to offer girls the same opportunities as boys to attend technical college courses in order to acquire technical qualifications it is doubtful whether they actively encourage girls to do so.

One factor which probably contributes to industry's reluctance to recruit girls to skilled trades and responsible posts is the wastage that takes place, particularly due to marriage. One witness, in giving evidence to the Council, was of the opinion that the average 'life' of a girl in industry is three years, and that consequently employers are not prepared to invest in training schemes for girls when the 'returns' are so insecure. This surely is a short-sighted view to take since many of these girls, if trained and later given the opportunity, might return to industry in subsequent years in much the same way as married women now return to teaching when their children outgrow the need for constant supervision.

Girls on their part are possibly reluctant to seek skilled and responsible posts in industry which require apprenticeship and training because of tradition that promotion in industry is a matter for men. This is particularly true in Wales where, until recently, the great preponderance of heavy industries gave women and girls little opportunity for any form of industrial employment. Though industrial opportunities for women are now far more numerous and they are being employed in Wales in greater numbers, their approach to the work continues to be different from that normally expected of a young man of comparable intelligence and education. Many young men go into industry expecting promotion—they want to get on. Most young women are content to get by. We think that their approach to industry could be changed if we ceased to regard women in general as incapable of acquiring scientific and technical education, if it were not so readily assumed that girls are better at arts subjects than in science, and, most important of all, if there were many more highly qualified teachers of science and mathematics in girls' schools. The shortage of suitably qualified teachers of science and mathematics in girls' grammar schools has undoubtedly caused the numbers of girls proceeding to Ordinary level and to Advanced level of the General Certificate of Education examination in recent years to remain lower than they would otherwise have been. Reference to Appendix N, in which some statistics relating to Advanced level examinations in the sciences and mathematics are given, shows that in 1958 six times as many boys as girls offered mathematics and physics at Advanced level in the General Certificate of Education examination of the Welsh Joint Education Committee. This situation might be improved by closer cooperation between some neighbouring boys' and girls' grammar schools whereby classes in these and possibly other subjects at sixth form level could be combined.

If advantage is to be taken of this potential source of scientific and technological talent to increase Britain's supply of scientists, technologists and skilled workers, not only will industry need to modify its attitude towards the recruitment and employment of girls and women, but schools will also need to encourage more girls, particularly those who hope to enter the teaching profession, to choose science and mathematics among their special subjects.

The Need for Further Diversification

The past twenty years has seen a complete change in the industrial structure of Wales. The coal, steel and tinplate industries have been hrought to a high degree of modern efficiency, and these have been joined by manufacturing industries which, in their diversity, have added strength to the country's economy. If this diversity could be extended to include industries which employ a high proportion of skilled labour, such as motor car and aircraft industries, the country's economy would be on a much firmer basis, and this can be advocated not only on economic but on general social grounds. It may be said that Wales is not so much short of skilled people but of the opportunities for skilled people to fulfil themselves in Wales. A greater diversity of industry would ensure that more young people who are capable of being trained as technicians and technologists could expect employment in Wales instead of seeking it elsewhere with the result that Wales loses not only skilled men but the kind of people who are natural leaders of the community.

Certain Government Departments, Local Authorities, Members of Parliament, together with organisations such as the Welsh Board for Industry, the Industrial Association of Wales and Monmouthshire, the National Industrial Development Council of Wales and Monmouthshire and the Welsh Economic Development Council have all played their part to make possible this second Industrial Revolution.

CHAPTER III

The Present Pattern of Technical Education

Present-day industry, with its increasing complexity and its ever-changing nature and structure, with constant pressures for changes in methods of production and manufacture in the light of new techniques, requires people who can readily adapt themselves to meet these changes. Changes in production techniques, such as those introduced by automation methods, may demand a re-deployment of workers. Mechanisation and automation are reducing the number of routine jobs which were carried out largely by semi-skilled and unskilled workers, but the machines which now carry out the work require skill in their operation, care and maintenance. Introduction of these methods therefore, generally, leads to an increase in the proportion of skilled to unskilled workers required. At the higher level, great ingenuity and skill are required among the scientists and engineers who design and develop these complex machines. The constitution of the labour force needs to be such as to preserve, at all times, a proper balance between research, development and production. The need, therefore, for a system of education and training which will ensure that those in industry can adapt themselves readily to changes in methods and techniques is of the utmost importance.

There are various categories of skilled labour in industry. The usual classification is:

technologist, technician, craftsman, operative.

There have been many attempts to define these categories and for the sake of clarity it is important to bear in mind the differences between them. For this purpose we accept the definitions offered in the White Paper on Technical Education for the technologist and technician:

> 'A *technologist* has the qualifications and experience required for membership of a professional institution. Most university graduates in engineering and other applied sciences, and a good proportion of holders of Higher National Diplomas or Certificates or similar qualifications, become technologists. A technologist has studied the fundamental principles of his chosen technology and should be able to use his knowledge and experience to initiate practical

developments. He is expected to accept a high degree of responsibility and in many cases to push forward the boundaries of knowledge in his own particular field.

'A *technician* is qualified by specialist technical education and practical training to work under the general direction of a technologist. Consequently, he will require a good knowledge of mathematics and science related to his own speciality. Examples of technicians in the factory are assistant designers and junior ranks of management on the shop floor.'

Craftsmen are trained in accepted techniques in industry and are distinguished from operatives in at least two respects. They are expected to know why as well as how machines operate and they are also expected to be able to make, mount or assemble component parts from technical description or engineering drawings. The basic qualification is the serving of an apprenticeship but there is a growing demand in some industries for paper qualifications such as City and Guilds certificates.

An *operative* performs work on machines, or on a plant, which does not demand the degree of skill expected from a craftsman nor the amount of education and training the latter receives. The degree of skill and the duration of training required varies widely from one industry to another.

In addition to the practical training received in industry the technologist and technician, in order to achieve their status, have pursued educational courses at technical colleges, which are conducted concurrently with the practical training they receive in industry, or, in the case of some technologists, degree courses at universities prior to the practical training. There is an increasing and welcome trend for craftsmen to pursue courses at technical colleges but this applies only in exceptional cases to operatives; examples of the latter are found in the iron and steel, and the chemical industries.

While undergoing training in industry to become a craftsman, technician or technologist, the employee is normally termed an apprentice with the appellation craft, student or graduate attached.

Craft Apprentices

Recruitment

Recruitment to craft apprenticeship is mainly from among young persons of 15 to 17 years of age, the period of apprenticeship normally lasting five years. The range of intelligence and ability of those recruited is very wide, and so is the standard and quality of practical training offered in industry. The range of skill required of the craftsman differs greatly from trade to trade, yet little, if any, regard seems to be paid to this in selection procedure, the length of training or the status of the trained craftsman.

Employers are using the Youth Employment Service to an increasing extent in recruiting craft apprentices, but there is reason to believe that there are many who are still ignorant of the facilities offered by this Service to the school leaver by providing information concerning the opportunities and prospects to be found in modern industry, and to industry by providing names and records of young persons who are deemed suitable for recruitment as apprentices.

The facilities a particular firm or organisation has for training apprentices, and its ability and willingness to meet the cost of such training, naturally affect the number it recruits. Smaller firms often have no apprentices of their own but recruit skilled workers who have been trained elsewhere. The difficulties of the small or specialist firm in providing adequate training for its apprentices have largely been overcome in certain areas by the establishment of Group Apprenticeship Schemes. In such schemes a number of firms collaborate to provide a comprehensive training for apprentices by arranging for each apprentice to gain experience with a number of firms in the group and so obtain a wider training than would be available in any one establishment. The majority of these schemes at present operate in the Midlands and in the Greater London area. There is no such scheme as yet operating in Wales although some areas, particularly those with a trading estate as a nucleus, seem admirably suited for this purpose.

A further limitation on the recruitment of apprentices may arise from restrictions on the maximum number recruited to certain trades which are imposed by Trade Unions. These restrictions are intended to safeguard against exploitation of apprentices and the dilution of the skilled labour force which might follow unrestricted recruitment. It is also felt that if no limit were set on the number of apprentices they would not receive proper instruction and adequate supervision in their practical training. The number of apprentices a firm may recruit to a certain trade may, therefore, not exceed a given proportion of the number of skilled workers, or journeymen, the firm employs in that trade. This proportion varies from trade to trade and applies to individual firms or organisations and not to the trade considered nationally. This latter point is of some importance because the proportion would clearly be different if it were estimated nationally and not firm by firm.

Replies to a questionnaire sent to industrial employers in Wales who employ 100 persons or more and to a 25 per cent sample of those who employ between 10 and 100 persons (See Appendix M) gave the following information:

Non-nationalised Industries

Number of organisations written to ... 628
Number of replies 350

	1955	1956	1957
(i) Number of vacancies for craft apprentices	1,320	1,329	1,323
(ii) Number of craft apprentices recruited ...	1,280	1,301	1,319

(iii) Estimated annual intake of craft apprentices over the period 1958-62 697

Nationalised Industries

Number of organisations written to ... 10
Number of replies 10

	1955	1956	1957
(i) Number of vacancies for craft apprentices	421	481	581
(ii) Number of craft apprentices recruited ...	404	481	559

(iii) Estimated annual intake of craft apprentices over the period 1958-62 325

The increase in the number of vacancies in the nationalised industries over the period 1955-57 is due to the National Coal Board which accounts for over half the craft apprentices recruited by these industries.

Although the estimated future requirements quoted above cannot be taken as completely accurate for the non-nationalised industries since some organisations in their replies did not supply this information (the building industry in South

Wales, for example, recruited 556, 514 and 414 in 1955, 1956 and 1957 respectively, but did not submit future estimates), the replies indicate that there is a substantial decrease expected in the annual recruitment of apprentices in the period 1958-62 compared with the period 1955-57. That this is true for industries in Wales generally was also revealed in oral evidence given to the Council by over a hundred industrialists.

Training

The apprentice receives the practical training for his craft at his place of employment and is normally taught the technology of the craft and the necessary auxiliary subjects, including some essential practical instruction, at a technical college. The latter training usually takes the form of a well-planned course designed by the City and Guilds of London Institute or by a regional examining body such as the Union of Lancashire and Cheshire Institutes, in conjunction with the industry, to meet the needs of a particular craft. Some industrial concerns, although they are few in Wales, have Works Training Schools where the apprentices pursue a full-time organised course of instruction and practical training for an initial period which may vary from six months to two years; day-release to attend technical college is usually granted during this period.

An apprenticeship scheme which merits special mention is that introduced in 1954 by the National Coal Board for colliery mechanics and colliery electricians. In this scheme the apprentice spends the first year of his five-year apprenticeship at a technical college which serves as his 'Works Training School' for two and a half days a week, and during the remaining two and a half days he attends classes in the theory of the craft and general education. During the second year he attends the college for two days a week, one of which is devoted to practical training. For the remaining three years he attends college on one day a week, and on one evening in some cases, for the City and Guilds or National Certificate course. The National Coal Board pays the local education authority the cost of the industrial or practical training part of the apprentices' course at the college.

Most firms now allow their apprentices to attend, without loss of pay, a technical college for one day a week in order to pursue vocational courses. This concession is granted by some firms until the apprentice attains the age of 21, while others discontinue it when the apprentice becomes 18. As mentioned on page 13 a more recent development is block-release, where the apprentice is released to attend college full-time for two or three separate periods of one month each a year. The first example in Wales was that established at the Usk Farm Institute in 1948 for blacksmiths' apprentices. This course was transferred to Newtown Technical Institute in 1953. Since the number of these apprentices in Wales is small, it is uneconomical to arrange day-release courses at those technical colleges near their places of employment, and a regional course is, therefore, held at Newtown Technical Institute which the apprentices attend full-time for two separate periods, each of a month's duration, in each year of their apprenticeship.

In 1954 a block-release course was arranged at Llandaff Technical College for Heating and Ventilating apprentices. Prior to this there was a day-release course at Cardiff Technical College, but apprentices found it impossible to attend the course regularly because their duties often took them to areas remote from Cardiff. The apprentice now attends Llandaff Technical College full-time for one month each term for four years. Of the ten who commenced the course in September 1954, nine completed it in June 1958, and all these were successful at the Final Certificate examination of the City and Guilds of London Institute appropriate to their work, a very substantial improvement on previous results.

Although the block-release type of course was introduced to gather together relatively few students scattered over a wide area, its educational advantages over the day-release course, provided there is continuity of study in the intervening periods, are apparent and are being recognised by certain industries, with the result that five additional block-release courses were introduced at Llandaff Technical College in September 1958, and also one at the Newport and Monmouthshire College of Technology. Continuity of studies in the intervening periods between full-time attendances is maintained whenever possible by attending college on one evening a week, or by setting a programme of work to be covered in these periods.

Courses of Study

The courses pursued by craft apprentices at technical colleges usually lead either to examinations such as those of the City and Guilds of London Institute or to National Certificate examinations. The latter demand a higher academic ability on the part of the student and success along the route to Higher National Certificate level normally means that the apprentice promotes himself from the rank of craftsman to that of technician and possibly technologist. This promotion route puts a high premium on the National Certificate and many apprentices embark on the National Certificate course with high hopes but fail to pass even the first-year examination (S.1). Of those who succeed in passing the first-year examination at the second or subsequent attempt, only a very small proportion eventually succeed in gaining the Ordinary National Certificate.

Although numbers vary from subject to subject, the following are generous estimates for National Certificate successes in Wales:

(a) succeeding in passing the first-year examination (S.1) at the first attempt —40 per cent.

(b) commencing at the first year of the course (S.1) and gaining Ordinary National Certificate without having to repeat a stage due to failure—10 per cent of the number who commenced at S.1.

(c) commencing at the first year of the course (S.1) and gaining Higher National Certificate without having a repeat a stage due to failure—3 per cent of the number who commenced at S.1.

The following table is a follow-up of a group of students (part-time day and evening courses) who commenced the first year of an Engineering (Mechanical and Electrical) National Certificate course at a technical college in Wales in September 1950, and is inserted because the Council is satisfied from evidence received that it is a fair representation of conditions generally in Wales:

1950-51				1951-52				1952-53				1953-54			
	Sat Exam.	Passed	Failed		Re-registered	Passed	Failed		Re-registered	Passed	Failed		Re-registered	Passed	Failed
S.1	147	66	81	S.2	57	27	30	S.3	27	9	18	A.1	6	5	1
				S.1	27	10	17	S.2	34	13	21	S.3	27	13	14
								S.1	4	1	3	S.2	11	3	8
												S.1	Nil	–	–

1954-55				1955-56				1956-57			
	Re-registered	Passed	Failed		Re-registered	Passed	Failed		Re-registered	Passed	Failed
A.2	5	2	3	A.2	8	6	2	A.2	1	1	0
A.1	10	4	6	A.1	4	1	3	A.1	2	0	2
S.3	11	5	6	S.3	2	2	0	S.3	Nil	–	–
S.2	4	1	3	S.2	Nil	–	–	S.2	Nil	–	–
S.1	Nil	–	–	S.1	Nil	–	–	S.1	Nil	–	–

Of the 147 that entered for S.1:

2 (1·4 per cent) gained Higher National Certificate without repeating a stage.
9 (6·1 per cent) gained Ordinary National Certificate without repeating a stage.
9 (6·1 per cent) eventually gained Higher National Certificate.
19 (12·9 per cent) eventually gained Ordinary National Certificate.
15 (10·2 per cent) left with S.2 only.
33 (22·4 per cent) left with S.1 only.
70 (47·6 per cent) left with no qualification on the National Certificate scheme.

Some of those who failed on the first and second years of the course undoubtedly transferred to craft courses leading to examinations of the City and Guilds of London Institute and succeeded in obtaining a craft qualification.

The failure rate of those taking courses leading to City and Guilds examinations is equally disturbing. Whereas those who fail on National Certificate courses can be transferred to City and Guilds craft courses, unfortunately there are no courses to which failures on these craft courses can be transferred.

The great majority of the City and Guilds examinations in craft subjects follow a two-tier pattern—an intermediate examination which is taken normally at the end of the third year of the college course, and final examination taken at the completion of the five-year course. In some subjects these examinations are taken at the completion of the second and fourth years of the course respectively. Intermediate and Final Certificates are awarded for success at these examinations. Furthermore, 'Full Technological Certificates,' as they are by now somewhat misleadingly called, are awarded in most subjects to candidates who have passed the final examination in the subject, who satisfy the Institute on their knowledge of allied branches of science or art, who have attained the age of 21 years, and have had appropriate experience in the application of their crafts.

In many of the subjects the academic ability required to succeed in obtaining a Final Certificate is more appropriate to that demanded of a technician. Large numbers fail even at the Intermediate stage because of the academic nature of the examination. That the examinations in some subjects are not suitable for the wide range of academic ability among craft apprentices preparing for them has recently been recognised by the City and Guilds of London Institute. In mechanical engineering, for example, a new examination—mechanical engineering craft practice—has been introduced as an alternative to the existing machine shop engineering examination. The new examination puts greater emphasis on practical work and less on academic ability than the machine shop engineering examination. A similar scheme is also being introduced in the building craft examinations.

Student Apprentices

Recruitment

The student apprentice is regarded as a potential technologist or high grade technician. The minimum educational standard demanded for entry to a student apprenticeship differs from one organisation to another and varies from passes in English, mathematics and science at the General Certificate of Education Ordinary level examination to passes in mathematics, physics and chemistry at the General Certificate of Education Advanced level examination. Craft apprentices may, in some organisations, be promoted to student apprentices if their attainment at the Ordinary National Certificate examination is above a certain level. The great majority of student apprentices are recruited from grammar school leavers in the age-range 16-18 years.

There has been a steady increase in the number of student apprentices recruited by industries in Wales during recent years. In response to a questionnaire sent to employers (see Appendix M) the following information was received in connection with student apprentices:

Non-nationalised Industries

		1955	1956	1957
Number of orgaisations written to ...	628			
Number of replies	350			
Number that recruit student apprentices ...	42			
(i) Number of vacancies for student apprentices		157	188	255
(ii) Number of student apprentices recruited		145	179	242
(iii) Estimated annual intake of student apprentices over the period 1958-62	202			

Nationalised Industries

		1955	1956	1957
Number of organisations written to ...	10			
Number of replies	10			
Number that recruit student apprentices ...	6			
(i) Number of vacancies for student apprentices		57	82	103
(ii) Number of student apprentices recruited...		49	65	74
(iii) Estimated annual intake of student apprentices over the period 1958-62	79			

It should be noted that in the figures quoted for the nationalised industries, those for 1957 include that of the National Coal Board which recruited student apprentices for the first time that year—44 vacancies and 32 recruited. The number of vacancies (59) and the number recruited (42) by the other nine nationalised industries were, therefore, lower in 1957 than in 1956. The estimated annual vacancies for the period 1958-62 for all industries (281) is less than that for 1957 (358). One possible reason for this pessimistic outlook is that the returns to the questionnaire were completed by employers during the economic crisis of 1958.

Training and Courses

The period of apprenticeship varies from three to five years, depending largely on the academic qualifications possessed by the apprentice on entry and also on the type of technical course he pursues as an integral part of his apprenticeship.

The apprentice who has appropriate passes at General Certificate of Education

Advanced level may pursue a university degree course, or a sandwich course at a technical college leading to either the Diploma in Technology or a Higher National Diploma. The choice of course will depend on his qualifications and on the educational policy of his employer. Pursuing a degree course means release from industry for a minimum period of three years; attending a sandwich Diploma course involves release for six months each year over a period of three to five years.

The apprentice recruited with passes at General Certificate of Education Ordinary level or similar standard will, as things are now, in all probability follow a National Certificate course on a day-release scheme although he is sufficiently qualified to take advantage of the facilities that exists in a few technical colleges for an Ordinary National Diploma course (two years) or a Preliminary Diploma course (one or two years) which he could attend on a sandwich basis. Success in either of these would lead him on to a Higher National Diploma or possibly a Diploma in Technology course. The majority, however, follow National Certificate courses, and for them, provided they gain an Ordinary National Certificate, there are at least four possible avenues:

(a) they may pursue a course leading to the Higher National Certificate;

(b) they may be admitted to some universities, including the University of Wales, provided they have a pass in English at General Certificate of Education Ordinary level and three years' industrial experience;

(c) they may be admitted to a Higher National Diploma course if they have 50 per cent marks or over in each paper of the Ordinary National Certificate examination;

(d) they may be admitted to a Diploma in Technology course provided they have 60 per cent or over in each paper of the Ordinary National Certificate examination.

Whether or not an apprentice pursues the highest level course for which he is eligible depends on his employer's training policy and willingness to release the apprentice to attend the course. Evidence given below shows that only a small fraction of those eligible, by virtue of Ordinary National Certificate qualifications, to pursue degree and diploma courses do in fact pursue them. The great majority continue on the National Certificate course to the Higher level by one day a week or three evenings a week attendance at a technical college.

An analysis of the types of courses pursued in the session 1958-59 by those students in Wales who gained Ordinary National Certificates in 1958 is given in Appendix A, from which the following facts are obtained:

(i) Number of Ordinary National Certificates gained in 1958 ...	800
(ii) Number of students who gained 60 per cent marks or over in each paper at these examinations	172
(iii) Number of students who gained 50 per cent marks or over in each paper (not including (ii)) at these examinations	244
(iv) Number of above students who entered university in September 1958	10
(v) Number of students from (ii) above admitted to a Diploma in Technology course in September 1958	3
(vi) Number of students from (ii) and (iii) above admitted to a Higher National Diploma course in September 1958	17

(vii) Number of students from (ii) above who pursued a Higher National Certificate course during 1958-59 122

(viii) Number of students from (iii) above who pursued a Higher National Certificate course during 1958-59 193

There are some disturbing features revealed in this information, features which ill accord with the alleged need to increase the number of the country's technologists:

(a) out of 172 students eligible for admission to a Diploma in Technology course by virtue of Ordinary National Certificate qualifications gained in Wales in 1958 only 3, so far as can be ascertained, enrolled for such a course in September 1958;

(b) out of a minimum of 244 students eligible for admission to a Higher National Diploma course by virtue of Ordinary National Certificate qualifications gained in Wales in 1958, only 17 are known to have enrolled for such a course in September 1958.

As for student apprentices directly recruited with appropriate General Certificate of Education qualifications to industries in Wales, there were 316 in 1957. Of these just over a hundred only were admitted to advanced sandwich courses in September of that year, leading to either a Diploma in Technology (14) or a Higher National Diploma (91). This fact is equally disturbing.

Those apprentices who are selected by their employers to attend advanced full-time or sandwich courses are, generally, paid their salaries or wages whilst at college. Those who are granted release to attend a course but are not paid for the periods spent in college may, as mentioned earlier in this Report, apply to their local education authorities for an award to cover these periods.

In most student apprenticeship schemes the practical training begins with a period of basic craft training in order to make the apprentice familiar with certain craft processes. The length of this period varies from scheme to scheme but usually extends over the first year or two of the apprenticeship. The nature of the subsequent practical training depends on the facilities available in the organisation. In one scheme submitted to the council in evidence, the apprentice is given successive periods of training in the drawing office, on design and development work, on commercial aspects such as costing and planning, on production control, and finally completes his training by carrying through a project involving some or all of these. In another scheme the apprentice spends nearly the whole of his practical training time in the drawing office.

The correlation of the practical training in industry with the educational course at the technical college is regarded as one of the main virtues of the sandwich system of training. Both industry and the college have their parts to play in ensuring that the student receives the maximum benefit from his training, which only a carefully designed and properly integrated course can give.

Graduate Apprentices

Some industrial concerns give graduates, when they are recruited direct from universities and without industrial experience, a two-year period of training during which the recruit is given the knowledge and experience considered necessary for him if he is to give his firm, and industry, the best possible service. During this time, he is termed a graduate apprentice. The professional institutions, in general, recognise the value of this training period by admitting the graduate into corporate membership when he has satisfactorily completed his apprenticeship and had subsequent industrial experience.

The returns to the questionnaire already referred to in the sections on craft and student apprentices give the following information relating to graduate apprentices in Wales:

Non-nationalised Industries

Number of industries that recruit graduate apprentices 14

	1955	1956	1957
Number of vacancies for graduate apprentices...	20	35	52
Number recruited	16	27	42

Estimated annual intake of graduate apprentices over the period 1958-62 39

Nationalised Industries ...

Number of industries that recruit graduate apprentices 2

	1955	1956	1957
Number of vacanices for graduate apprentices...	11	11	11
Number recruited	3	4	7

Estimated annual intake of graduate apprentices over the period 1958-62 7

The National Coal Board operates a scheme which it calls a scheme of Directed Practical Training. Recruits holding degrees, or comparable qualifications, in appropriate subjects undergo training for a period of up to three years under this scheme—a scheme for the systematic training of the managers and senior officials of the future. For the years 1955, 1956, 1957 and 1958 the numbers of vacancies in the South Western Division of the Board for such trainees were 60 for each of the first three years and 47 for 1958; the numbers recruited were 35, 58, 58 and 40 respectively.

Only in exceptional cases are graduate apprentices released to attend courses at technical colleges since it is assumed that they have already completed their academic training. Those earmarked for administrative or managerial posts may however, be released to attend a course in management studies conducted either at a technical college or within industry.

CHAPTER IV

Observations and Recommendations

There is no doubt that the present provision of technical education in Wales measured by the demands of industry and by the numbers and quality of students who present themselves, is more than adequate. Whether there are other criteria than these to be applied is worth considering later. The local education authorities have done admirably by providing accommodation and staff to satisfy the accelerating demand since 1945 made by industry for the training of workers of all grades. They may have done too much in certain directions so that the provision outruns the demand. The Council hopes, now that the urgent need for expansion in teaching accommodation has largely been satisfied, that local education authorities will turn their attention to improving, where necessary, the provision for student amenities at the colleges, and will at least note with interest the inclusion in the Welsh College of Advanced Technology of a college chapel.

The present provision of technical education is closely related to the demands of industry and, if this relationship continues, must reflect the changing demands of industry. To forecast, even for the next decade, what these are likely to be at a time when technical knowledge and practice are developing and advancing at their present pace, is difficult if not impossible. All that can safely be said is that the content of technical education must be flexible and adapted to meet these changes. But it is not merely the needs of industry that have to be met. There is force in the argument that technical education should not be the handmaiden of industry but rather should enjoy the freedom and status of an education in its own right, conceived so as to develop intelligence and adaptability and to produce in consequence a person with a trained and versatile mind capable of assuming responsibility. It is essential to distinguish between technical education in its broad and liberal sense and technical instruction which is training in acquiring specific skills. The former is regarded as a whole of which the latter is a part. While the latter tends to place young persons in a groove, albeit a smooth and efficiently run groove, the former has a proper concern for flexibility and adaptability. Craftsmen, in short, should not only be trained in certain skills but also be educated to adapt themselves to new skills which technical advances in production methods may reveal. It would follow from this that the education of the craft apprentice should be less specialised than is the case at present and that more attention should be paid to basic scientific principles which underlie his own as well as other craft skills; the first years of a craft apprenticeship should not therefore be spent in training designed for a particular trade but rather on a course of a more general character carefully drawn up so as to introduce the discipline that produces the mind trained to think.

In our view there is no incompatibility between the immediate need of industry for skilled workers and the need of society for individuals whose education while fully training them in their appropriate skills also equips them to enjoy more abundant lives. Anything which affects a person so closely as a system of education should be geared in the first place to his intrinsic needs as an individual with civic, social and family responsibilities but he need not on that account be less efficient at his work. A carefully designed system of education could satisfy both these requirements. This is even now largely achieved in advanced sandwich courses, in which the teaching of technological subjects at the technical college and the students' practical work in industry are closely allied, and form an integrated course. It is usual to add that liberal and cultural studies are regarded as an essential part of these courses. These studies require definition—it is an attitude of mind which informs the whole approach to the work both in the college and the workshop. It is inside the technology that a liberal spirit is rightly engendered; for example architecture would help in building, some history of the technology would help in engineering. To set aside certain periods a week for what are called cultural subjects is not enough. It is more difficult to achieve this design in day-release advanced courses and craft courses owing to the much shorter time available for the college courses and to less integration between the work done at the college and that at the place of employment.

Craft Apprentices

Recruitment

The Council found it necessary to conduct its investigations over a comparatively lengthy period and it was noted that comments made by employers on the quality of recruits to craft apprenticeships varied considerably during this time. Early in 1956 a number of employers complained that the educational standard and personal qualities of many of the applicants were disappointing and that in order to fill the vacancies available they were compelled to recruit, as craft apprentices, many boys who did not measure up to the desired standard. Evidence received during 1957 and 1958 however showed a continuous improvement in the situation, with an increasing number of applicants giving employers the opportunity of being more selective in recruiting apprentices. Reference to Appendix M, which gives an analysis of returns to a questionnaire sent to industrial employers in Wales, shows that the number of applications received for craft apprenticeships, by those employers who replied to the questionnaire, increased from 4,559 in 1955 to 5,505 in 1957, i.e., by 21 per cent, while the number of craft apprentices recruited increased from 1,684 to 1,878, i.e., by 12 per cent. The National Coal Board accounted for 95 per cent of this increase. Although no corresponding figures can be quoted for 1958 there is reason to believe that the number of applications continued to increase but that the number recruited decreased. Ministry of Labour figures for boys entering 'apprenticeships to skilled crafts' in Wales in 1957 and 1958 were 2,894 and 2,706 respectively. The corresponding figures for girls were 393 and 382 (see Appendices H, J, K, L.). With the number of school leavers increasing much more substantially during the next few years, owing to the post-war increase in the birth-rate, the number of applicants for craft apprenticeships will increase annually, yet the number of vacancies available in Wales, according to the analysis in Appendix M, may decrease.

Recruitment to craft apprenticeships—training in the skills—is left to the discretion of the various industries, and these, in the main, recruit with their current needs in mind rather than the long-term requirements of either their own concern or the industry as a whole or of the nation. This method of maintaining a competent and sufficiently large force of skilled labour to meet the national needs is very haphazard. Changes in the economic climate of the country immediately affect the demand for apprentices with the result that the number recruited for training at a particular time bears closer relation to the immediate needs of industry for skilled labour rather than to the needs in four or five years time, when these recruits will have completed their training and will join the nation's skilled labour force. It is the exceptional and usually the large employer who is capable of taking a long-term view of his labour needs and recruits accordingly.

The restriction imposed by the trade unions on the maximum number of craft apprentices recruited to a given trade, by limiting the number a firm may recruit to a given proportion of the number of skilled workers or journeymen the firm employs in that trade, is surely a handicap to any firm that may wish to expand its activities rapidly. Another result of this restriction, as it is operated at present, is that, nationally, the number of apprentices being trained for any one trade may be considerably less than would be the case if the given proportion of apprentices to skilled workers were applied on a national basis. Many firms are not able or willing to recruit their full quota and from a national standpoint, therefore, it is desirable to allow firms that wish to recruit in excess of their quota to do so, provided regard is paid to the overall national figure.

Group Apprenticeship Schemes in Wales could well lead to an increase in the number of craft apprenticeships available and also to an improvement in the standard of training that many firms can now offer their apprentices. Many small firms, whose individual training facilities are naturally limited and who for this reason do not at present recruit craft apprentices, would probably do so were there Group Apprenticeship Schemes available.

From both written and oral evidence given to the Council there seems little prospect of any increase in the number of craft apprenticeships offered in the immediate future. It seems from this that industries in Wales will contribute little to the increase in the number of Britain's craftsmen that the Government hopes will be achieved in the next few years. If long-term national needs for craftsmen exceed industry's estimated needs, then the deficiency must be met either by inducing industry to train more than it thinks it needs or by supplementing industry's contribution by a national apprenticeship scheme, or by some other methods, which incidentally would have the further advantage of giving a training which is likely to be broader and more effective than many present training schemes.

In selecting recruits for craft apprenticeships it is doubtful whether industry, generally, takes the care and attention it should to ensure that the best choice is made. Some firms and organisations take great care over this, taking into account headteachers' reports, Youth Employment Officers' observations and recognised selection test procedures, but too often too much weight is given to other and less relevant factors. Although the Council agrees that family tradition in a craft can do much to instil pride and enthusiasm in a youngster for his craft, it is of the opinion that undue preference in recruitment should not be given to the sons of employees nor to those who come by some personal recommendation, unless these candidates are suitably qualified in respect of educational requirements and personal qualities.

Training

The period of craft apprenticeship, by trade union regulation, is now invariably five years, irrespective of the trade, and must be completed when the apprentice attains the age of 21. Although the latter condition has always been maintained, the age of entry into apprenticeship, and consequently its duration, has varied with the school-leaving age. In the last century a seven-year training period was usual but as the school-leaving age gradually increased, in the early years of this century, so did the age of entry into apprenticeship. Most trades now quote 15½-16½ years as the age range for admission to a craft apprenticeship. Boys who remain at school, either to pursue extended courses of a semi-vocational nature or to sit the General Certificate of Education examination, are often denied the opportunity of entering a craft apprenticeship because they are older than the stipulated maximum age for admission. Moreover, many boys who could profitably pursue such a course now leave school prematurely in order to secure craft apprenticeships. Any policy of adhering to the age limits as applied at present to craft apprenticeships is contrary to the belief held by many that a shorter period of apprenticeship would be adequate in many trades, and discourages boys and girls from remaining at school for as long as they can profitably follow the courses offered.

In connection with pre-apprenticeship training the Council notes with interest the recent introduction of one-year full-time courses at technical colleges. These, in addition to giving the student intensive training in technical subjects and introducing him to the craft in which he hopes to serve his apprenticeship, also give him the opportunity to familiarise himself with the ways and methods of a technical college. When he returns the following year as a day-release student his previous experience of college studies will be of considerable value to him. Given qualified staff and suitable equipment, this pre-vocational training can be done equally well at secondary modern schools, with consequent advantage to the schools of developing '15+' courses. Where the demand for such courses would not warrant their being conducted at all secondary modern schools the Council is of the opinion that certain schools should be selected to serve prescribed areas.

An apprenticeship scheme which incorporates at least a year's full-time attendance at a technical college (e.g. the National Coal Board's scheme for colliery mechanics and electricians) or at a Works Training School (with day-release attendance at a technical college for the theory of the craft) has much to commend it. The apprentice will receive in his first year a sound and broad practical training which will form the foundation on which to build the craft skill in the subsequent years of the apprenticeship.

Although the block-release type of course has only recently been established, the Council feels confident in recommending its merits over the day-release course to those industries that are able to release their apprentices for periods of up to one month's duration three times a year. It hopes that these courses will develop on a wider scale in Wales both for their educational merits and for the opportunity they afford those apprentices who cannot attend day-release classes owing to travelling difficulties. Care, however, must be taken that block-release courses for operatives and craft apprentices are designed to suit the academic abilities of the students. Full-time attendance of one month's duration at the college gives the student greater continuity of study than the one day a week course, but too much emphasis on theory, given in lecture form without adequate leavening with demonstration and laboratory practical work, might, in this concentrated form, lead to his suffering from 'academic indigestion.'

Whether or not an apprentice is released with pay to attend classes at a technical college depends largely on the type of industry in which he is employed. Some industries release their apprentices until they attain the age of 21 and, in certain cases, beyond this; other release them only until they become 18, while some grant no release, with pay or without. The Council urges industry to eliminate these discrepancies in its concessions to apprentices and to grant release with pay to all apprentices throughout the period of their apprenticeships, subject to satisfacory progress being maintained.

Courses of Study

The courses pursued by craft apprentices at technical colleges can be divided into two main categories—National Certificate courses, and craft courses in preparation for the examinations of the City and Guilds of London Institute. As mentioned earlier in this Report, the high esteem in which National Certificate qualifications are held in industry causes many apprentices to embark on a National Certificate course because of the promotion prospects it offers, although their academic abilities and stamina are not equal to the demands made. As a result considerable wastage occurs in the first and second years of National Certificate courses with consequent feelings of frustration among the 'failures', many of whom then transfer to City and Guilds courses. This practice, whereby numbers of apprentices must experience failure in the early years of a National Certificate course in order to convince themselves, and possibly their employers and college staffs, that their academic abilities are not of the standard required to succeed on that course and that they are better suited to a craft course, is, in the Council's view, most unsatisfactory.

Evidence submitted to the Council concerning wastage on National Certificate courses, an example of which has been given earlier in this Report (page 37), is disturbing. It is a problem not peculiar to Wales since similar figures are quoted for other regions in Britain. These high rates of failure can, *inter alia*, be attributed to:

(a) insufficient attention to a student's academic ability prior to enrolment in the first year of the course. Since a National Certificate course requires a fairly high level of academic ability on the part of the student if he is to pursue the course successfully, the Council thinks that it would be better to replace the present entry qualification to the course by one which gives a truer indicaton of the student's academic ability. It therefore suggests that the Prelimary National Certificate and the present first-year stage (S.1) be abolished and that entry to the National Certificate course be at what is the present second-year (S.2) stage. The course would therefore be two years to Ordinary National Certificate level and a further two years to the Higher level. Furthermore, minimum entry qualifications should be a pass in four appropriate subjects at the General Certificate of Education (Ordinary level) examination, these having been gained at not more than two attempts. The Council is of the opinion that a universally recognised qualification of this standard, which can be obtained either at school or at a technical college, provides a better diagnostic test than the present S.1 examination and, moreover, should the student subsequently fail to obtain an Ordinary National Certificate, the General Certificate of Education qualification will be of more value to him than success at the S.1 stage, if he wishes to transfer his interests to other fields. Transfer from craft courses to National Certificate courses, at appropriate levels, should continue as at present;

(b) lack of suitably trained teachers. Owing to the great demands of industry for scientists and technologists in the post-war years, technical colleges have suffered a shortage of qualified trained teachers. Many of the present teachers, although they possess academic qualifications in the subjects they teach, have had no training in the methods of teaching. Among the recommendations of the Special Committee on the Training and Supply of Teachers for Technical Colleges, published in May 1957, was one that there should be an expansion of the provision of short courses and part-time courses offered regionally by local education authorities and Regional Advisory Councils for Further Education. These would afford facilities for both full-time and part-time teachers in technical colleges, who hitherto have not pursued a course of professional training, to follow courses in the general principles of teaching and with particular reference to the teaching of technical subjects. Such courses in Wales, held during the session 1958-59, were a week's residential course on the teaching of mathematics in technical colleges organised by the Welsh Joint Education Committee, and a part-time course on general principles of teaching, held on Saturday mornings over a period of twelve weeks, organised by the Faculty of Education of University College of North Wales, Bangor, at Wrexham Technical College. In the summer of 1957, Flintshire Education Authority, in conjunction with the Technical Teacher Training College at Bolton, organised at the Flintshire Technical College a week's course on general principles and special techniques in technical teaching. As a part of its annual 'Summer School' for teachers, Carmarthenshire Education Authority includes a section on teaching methods in technical subjects, for teachers in technical colleges. In September 1953, part-time courses were started at the College of Technology and Commerce, Cardiff (now the Welsh College of Advanced Technology) to prepare for the Technical Teacher's Certificate of the City and Guilds of London Institute. The Certificate is intended for part-time teachers engaged in further education establishments or those wishing to take up such part-time teaching. It is also available to serving full-time teachers in technical institutions, industry, hospitals, etc., who have not previously pursued a teacher's training course. Two part-time courses are offered—one involving attendance on one afternoon and an evening a week for one year, and an alternative course which is held on one evening a week for two years. It is understood that enrolments to these courses have been disappointing, which may be evidence of an attitude of complacency in technical colleges which must be eliminated.

Although the Council is pleased to note the provision already made in this direction, it considers that it is very inadequate to meet the present need and would urge local education authorities, governing bodies and principals of technical colleges to do all in their power to provide courses and to encourage the attendance of both part-time and full-time teachers at such courses by granting release where necessary and by financial assistance. We understand that there is a proposal, sponsored by the Welsh Joint Education Committee, to organise courses during summer terms at the Welsh College of Advanced Technology for teachers already employed in technical colleges. We hope that it will receive the full support of local education authorities and that all teachers in the colleges, not so trained, will have an opportunity of attending these courses;

(c) insufficient liaison between industry and technical colleges to ensure that the student's best interests are served. Both industry and technical colleges should make sure that the student pursues the course best suited to his abilities. There is evidence that certain firms expect their apprentices to embark on National Certificate courses when a City and Guilds course would be more appropriate. Whether this is done for reason of prestige or from ignorance both of the standard required for success in the course and of the existence of more suitable craft courses, the matter is one which should be given careful and urgent attention. Errors of judgment of this kind can have serious consequences for the apprentices concerned, and Education and Training Officers attached to firms and organisations have a special responsibility to collaborate with college principals so that the best interests of the students should be served;

(d) lack of application to their studies on the part of many of the students who are directed by their employers to attend these courses, but have no wish or desire of their own to do so. The fact that failure in the educational course will not impair his chances of successfully completing his apprenticeship, and that success in the course often carries no hope of immediate promotion or financial gain, discourages many a less ambitious apprentice from persisting in studies which appear to him to be of no purpose. Regular supervision and encouragement of the students in their studies by parents, industry and technical college authorities, would go a long way to eliminate much of this apathetic attitude shown by some students to their studies;

(e) the part-time nature of the training given in day-release courses, with six-day gaps between consecutive attendances, often makes it difficult for the less able student to obtain a grasp of any issue, the teaching of which, under this system, may be spread over many weeks. Undue time must be spent in recapitulation at the beginning of each lesson. The block-release course, with its several periods of full-time attendance, gives an opportunity for continuity of study and for the introduction, moreover, of subjects other than those required strictly for examination purposes. Although these courses have only recently been introduced there is already evidence to show that examination results of block release students are better than those of students on corresponding day-release courses. For example, examination successes of students who pursued courses at Llandaff Technical College in 1958-59 were as follows:

Subject	Examination Successes	
	Block-release Course	Day-release Course
Mechanical Engineering (Ordinary National Certificate) ...	83 per cent	76 per cent
Machine Shop Engineering—Intermediate	62 per cent	30 per cent
Electrical Installation—Course C	88 per cent	65 per cent

As already mentioned on page 46 the Council hopes that block-release courses will increase in number and that employers will release their apprentices to attend them.

Much of what has been said above in relation to the high failure rate on National Certificate courses applies equally to the high rate of failure on craft courses in preparation for the examinations of the City and Guilds of London Institute. The wide range of intelligence among the craft apprentices who pursue these craft courses, and the comparatively high academic standard of some of the examinations, are factors which contribute to the present failure rate. The recent introduction of additional examinations demanding both a lower academic standard and a more practical approach, in some craft subjects, will give the less academically-minded but, nevertheless, capable and satisfactory apprentice an opportunity to succeeed, whereas hitherto he would have failed. The Council therefore welcomes this development and hopes that it will spread to craft subjects generally.

Finally, the Council is of the opinion that industry can do much to reduce the failure rate by making every effort to ensure that it makes the best possible choice when selecting craft apprentices. The Council strongly recommends that industry and headteachers of secondary schools, particularly those of secondary grammar schools, make the best possible use of the Youth Employment Service. The Council believes that if industry, schools and parents used the Service to the fullest possible extent and if the Service were extended to provide more fully for all types of schools, then the problem of placing school-leavers in the grade and type of employment best fitted to their abilities and aptitudes would be nearer a solution.

A New Approach to Craft Apprenticeship

It has already been mentioned (page 44) that recruitment to craft apprenticeships is, in the main, carried out with current needs of industry in mind rather than long-term requirements. If the nation is to maintain its reputation in industrial development and production against keen competition from other countries, its supply of skilled workers must be adequate and must not be influenced by such factors as short-term fluctuations in the country's economy. An example of present practice was the reduction in the number of craft apprenticeships offered to school leavers in the summer of 1958, following the credit restrictions imposed earlier that year. The effect of this reduction will be felt in 1963 when these apprentices complete their apprenticeships and take their places as craftsmen in industry. At that time pupils in the co-called 'post-war bulge' will be leaving the secondary schools and, becoming wage-earners, will increase the demand for consumer goods. This increasing demand will, in turn, call for employment of more workers including craftsmen, and will occur at a time when the supply of craftsmen will be reduced owing to the fall in craft apprenticeships offered in 1958.

Another serious defect in the present craft apprenticeship system is that the standard of practical training given to the apprentice differs greatly from one firm to another. Some apprentices are fortunate in that their employers conduct well-planned schemes of practical training which may include a year or two at a Works Training School. The training received in this way gives them every opportunity to familiarise themselves with various aspects of the craft and prepares them well for careers as craftsmen. Many others however are not so fortunate, and they receive training which is narrow in its concept and is of poor standard. A craftsman so trained often finds himself incompetent to carry out his duties satisfactorily, particularly if he moves to another firm whose methods may be different from those of the firm at which he served his apprenticeship. A system which allows the standard of practical training an apprentice receives to depend completely on the facilities which his employer can offer is unsatisfactory to the trade and unjust to the apprentice.

How can these defects of fluctuating recruitment and varying standards of practical training be remedied? Since the future prosperity of the country depends on, among other things, an adequate supply of competent craftsmen, the Council regards the responsibility of recruiting and training craft apprentices as a national one. The position in Wales differs in many respects from that in many parts of England and in the opinion of the Council the only satisfactory solution would be the establishment of a national craft apprenticeship system which would be administered by the State through the Ministry of Education working in turn through appropriate bodies representative of the interests involved and so free individual industries of the responsibility for providing basic craft training. The Council realises that this system must operate over the United Kingdom as a whole before it can be successful in Wales, but it cannot for that reason refrain from considering it.

In such a scheme as the Council envisages, the apprentice would be admitted to an Apprentice Training Centre, normally at the age of 16, although provision would be made for entry at a later age. The centre may or may not be an integral part of an existing technical college, and would give a full-time course of practical training lasting three years, of which two would be spent on a broad and sound training in the skills and basic requirements of a group of related crafts and the third more directly aligned to the needs of the trade the apprentice intends to follow. Maintenance grants on a sufficiently generous scale to encourage young persons to undertake apprenticeships rather than go into paid full-time employment which would be likely to be blind alley should be provided. Attendance at technical college courses would be on an ampler scale than is the case generally for apprentices at present; two days a week or one month a term, with supervised study in the intervening periods spent at the training centre, would be arranged. It is only on the completion of the three years' course that the apprentice would be given employment and he would continue to be an apprentice for a further two years during which time he would gain experience, and acquire the ability to use the skill and craft knowledge he possesses, in industry.

While the Council is not in a position to elaborate this scheme in detail it hopes that the following ideas, among others, will receive careful consideration. Industry could contribute towards the maintenance of the centres through an Apprenticeship Levy imposed on every firm or organisation employing craftsmen and technicians. A National Apprenticeship Council, fully representative, would determine policy concerning the number of training centres required and their geographical distribution, and also what training facilities are to be offered in various areas. From estimates obtained annually from industry of the number of craftsmen and technicians needed, say, in three or four years time together with knowledge of the Government's plans for industrial development, the Council would determine the annual intakes into the centres. The selection of candidates for apprenticeships would be made by Area Apprenticeship Committees who would also be responsible to the National Council for the efficient conduct of the centres in their respective areas.

Among the advantages to Wales of a National Craft Apprenticeship system would be:

(i) recruitment to the apprentice training centres could be controlled so as to meet the estimated need for skilled craftsmen and technicians judged by the prospects of establishing new industries and the expansion of existing ones;

(ii) education and industrial training could be more closely related than they are at present;

(iii) the standard of training would be more uniform throughout the country and of a level at least comparable to the best given at the present time. This is of particular importance because of the large proportion of small firms in Wales;

(iv) the training could easily be adjusted, when necessary, to meet the changing needs of industry caused by the introduction of new methods and techniques;

(v) the technical college course, with the additional time allocation, would include subjects other than those concerned directly with the vocational interests of the apprentice;

(vi) it would give the school-leavers in rural areas an equal opportunity of gaining apprenticeships with those from the towns and cities in industrial areas.

The Council is aware of the problems involved in changing from the present system to a national one and it also appreciates the difficulties that would be encountered in administering the scheme. Not the least is finding suitably qualified teachers in sufficient numbers. A necessary preliminary step would be to establish in one of the training colleges of Wales a course designed for such teachers. Furthermore it realises that the system would succeed only if it were given full and active support by the Government, industry and the trade unions. In spite of the problems and difficulties involved, the Council believes that the change is necessary. In this respect the Council finds that it differs from the conclusions of the Carr Report *Training for Skill** and the recent report of the Central Advisory Council for Education (England) *15 to 18*.†

The policy of establishing a national craft apprenticeship system, were it to be realised, must at present be regarded a long-term one, even if only on account of the time that would be taken, among other things, in setting up the training centres. In the meantime, and as an alternative if a national system is unacceptable, the Council recommends that the five-year craft industrial apprenticeship period be reduced to three years provided that all apprentices recruited by industry at 17-18 years of age have had a two years full-time course in the basic subjects associated with technical education. This two years course would be given in a place of full-time education staffed and equipped for the purpose. This might be a specially selected school serving an area or a college of further education, depending upon local conditions. The full-time course would begin at between 15 and 16 years of age and extend to between 17 and 18 years when an appropriate examination would be taken. The examination would best be an external examination conducted in Wales by the Welsh Joint Education Committee. Industry would interview applicants for industrial apprenticeship during the last term of the course and make the final selection after its completion.

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* para. 18. '. . . the responsibility for the industrial training of apprentices should rest firmly with industry. . . .' Her Majesty's Stationery Office, 1958.

† *loc. cit.*

The basic subjects in the full-time course would be those common to the training of apprentices in practically all branches of industry and would include English, mathematics, physics, chemistry, engineering drawing, and an extensive course in workshop practice and technology. The content of each syllabus would be appropriately related to general industrial requirements and would emphasise practical applications. In certain areas a bias towards a particular industry would be acceptable and might be advantageous provided the basic quality of the training is not materially affected. The course would not be confined to the above subjects, but would also include other subjects of cultural importance in the education of future citizens and make for greater adaptability, the importance of which has already been emphasised.

The Council is aware that not all those who pursue this special full-time course would be successful in being accepted by industry for industrial apprenticeship, but it hopes that the number in this category would be small and that industry would cooperate fully in making use of all those who successfully completed the course. In any case the resultant general raising of the level of educational training given to such a large additional section of the community could have nothing but a beneficial influence upon our society. The scheme would bring to technical education an orderliness which is now lacking and would avoid the dilemma, in which many pupils find themselves, of having to decide at 15 or 16 years of age whether to accept an apprenticeship and forego the opportunity of sitting the General Certificate of Education examination or to remain at school for the latter purpose with the possibility of losing an apprenticeship through age restrictions. Even though the suggested course would be directed towards an apprenticeship examination, pupils wishing to do so would still be able to sit the General Certificate of Education examination at the appropriate time.

Advanced Courses

Increased Technical College Provision

In its White Paper on Technical Education, issued in 1956, the Government announced a programme for the development of the technical colleges of the country, including the up-grading of a number of colleges to be colleges of advanced technology, and a proposal to expand the capacity of advanced courses at technical colleges to produce an annual output of 15,000 instead of the then existing 9,500. Great stress was laid in the White Paper on the value of sandwich courses and the hope was expressed that industry and local education authorities would give every opportunity to those students who proved themselves capable of benefiting from a course of advanced study, and would encourage them to pursue either a full-time or a sandwich course for this purpose.

Disappointing Response in Wales to Advanced Sandwich Courses

The response in Wales, to date, to this appeal has been very disappointing. Courses at the Welsh College of Advanced Technology in mechanical engineering and in electrical engineering bave been approved for the award of a Diploma in Technology, but as mentioned on page 41 the enrolments to these courses have so far been low. Although the College has been authorised to conduct a course for the award of a Diploma in Technology in applied physics since September 1958, the demand to date (January 1960) has been insufficient to warrant starting it. Enrolments to Higher National Diploma courses at this College and at other technical colleges in Wales are also low. The fact that less than two per cent of those eligible for admission to a Diploma in Technology course, by virtue of Ordinary National Certificate qualifications gained in 1958, did actually enrol for such a course in September 1958 and that seven per cent is a generous corresponding figure for enrolment in a Higher National Diploma course is difficult to understand in view of present circumstances. On the one hand, the country is in urgent need of qualified scientists and technologists, and facilities for training these have been provided at certain technical colleges; on the other hand, students who, on day-release courses for ordinary National Certificates, have proved themselves capable of benefiting from advanced sandwich courses and attaining the above qualifications, do not enrol for them but continue with day-release courses for Higher National Certificates. Although the student can attain the status of a technologist via the Higher National Certificate route, to quote the White Paper on Technical Education—'as technologies grow more complex and the need for versatility increases, the strain of reaching these high qualifications by evening work or by studies on one or two days a week becomes more severe'. The Council is of the opinion that the advanced sandwich diploma course should become the accepted route, other than a university degree course, to the status of technologist, and that the Higher National Certificate should become the recognised qualification for a high-grade technician. Whilst the Higher National Certificate route to technologist status would still continue, with more generous release, the Council hopes that it would be taken exceptionally by a minority of suitable Ordinary National Certificate holders rather than by the majority as at present.

The solution to the problem of providing industry with the increasing number of highly qualified people that it needs lies, to a large extent, in industry's own hands. The facilities for training are available but industry, generally, although ready to grant its employees one day a week release to attend courses, seems reluctant to offer them the opportunity to attend advanced sandwich courses. The Council hopes that this apparent lack of interest in the recently developed sandwich courses is only temporary, and that industrialists, principals of technical colleges and local education authorities will do all in their power to ensure that those capable of benefiting from advanced courses in science and technology are encouraged in every possible way to attend.

The lack of support for the sandwich course in chemistry or industrial chemistry in South Wales, where there is now a concentration of a variety of chemical industries, causes concern. During the session 1958-59 there were only seven students following full-time or sandwich courses (four full-time and three sandwich) in chemistry at the Welsh College of Advanced Technology, and an attempt to establish a Higher National Diploma Course in chemistry at the College in September 1959 attracted four students only, all being direct from grammar schools. The result was that the course was not started. Without some improvement in numbers a time may come when the very existence of other courses will be in jeopardy. Yet a considerable number of the students who took the Ordinary National Certificate examinations in chemistry in 1958 and 1959 did well enough to justify the belief that, given the opportunity, they would qualify for the Graduateship of the Royal Institute of Chemistry by means of a three-year sandwich course leading to the Part I examination and a further two-year sandwich or one-year full-time course leading to the Part II examination. It is reasonable to suppose that if industrialists did more to encourage the education and training of National Certificate students who show promise, they would recruit fewer graduates from universities and thus, indirectly, relieve the shortage of graduate science teachers in schools.

The present lack of support for advanced courses in science and technology at the Welsh College of Advanced Technology will, if it continues, create doubts as to whether the existence of a college of this status in Wales can be justified. Some of the larger firms in Wales send their apprentices to advanced sandwich courses at colleges of advanced technology and other technical colleges in England and ignore the facilities offered by the Welsh College of Advanced Technology. Much of the support that was envisaged when the College at Cardiff was nominated has thus not materialised. In spite of this the Council is of the opinion that sufficient support would be forthcoming to justify the College's existence if:

(a) industry is willing to release, for the necessary six-monthly periods, those employees capable of benefiting from Diploma in Technology and other advanced sandwich courses;

(b) principals of technical colleges were to advise and encourage those students who do well at the Ordinary National Certificate examinations to transfer to advanced sandwich courses rather than pursue Higher National Certificate courses, and made sure that these students know about the local education authority awards available for the 'college' periods of the course if their employers are unwilling to finance them during these periods;

(c) there were a planned provision of advanced courses to avoid unnecessary duplication at this and other colleges.

The Welsh College of Advanced Technology and the University of Wales

Another matter on which it is relevant for the Council to comment is the relations that might exist between the Welsh College of Advanced Technology and the University of Wales. The work of the former is described elsewhere and some of the problems it faces have been touched on. Some recent developments in applied sciences in the University have also been noted. It is reasonable to ask whether at the advanced stage of study represented by the College of Advanced Technology and University Departments of Applied Science there is the degree of cooperation and collaboration which was hoped for in the White Paper on Technical Education* and which might fairly be expected of people engaged in technical education at much the same level alheit in the different contexts of sandwich courses in preparation for the Diploma in Technology in the former and full-time courses in preparation for university degrees in the latter.

It seems to us that there is a dignity and status attaching to university education which in Wales at any rate the higher reaches of technical education do not enjoy. It may be that the College of Advanced Technology in Cardiff has not yet had time to acquire the status that its title implies and that industrialists in Wales have not given it the support to which it is entitled. It may be that there are prejudices against technical education among parents and teachers of grammar school pupils that must be overcome. It may be that the traditional disposition and temper of Welsh people is towards book-learning which they associate with the university rather than towards practical studies which they associate with technical colleges. However, it seems to us that a real effort must be made to persuade Welsh people —teachers, parents, industrialists and pupils—that technical education at the highest level outside the university can be as satisfying and rewarding in its disciplines, its standards, its freedom and its opportunities as university education and more appropriate to many pupils.

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* para. 75, White Paper on Technical Education, 1956, states:

> 'These [Colleges of Advanced Technology] and all other colleges engaged on advanced work will be expected to develop close contacts with the appropriate universities. This is done today both direct and through the Regional Academic Boards for Technical Education on which the universities, the local education authorities, the technical colleges and industry are represented. It seems probable that the resources of both universities and colleges could be coordinated to greater effect than is sometimes the case at present.'

An important step in this act of persuasion would be to establish a close association between the Welsh College of Advanced Technology and the University of Wales. It should not be forgotten that the Charter and Statutes of the University of Wales contain precise references to technological studies and it may well be that this is an opportune time to realise in practice the clear intentions of some at least of the founders of the University of Wales and of University College, Cardiff, that technological education was well within the proper purview of a university. Since then the University has become increasingly aware of its obligations to the highly industrialised and mechanised world in which it is set and would today recognise as never before that its concern properly lies with all knowledge irrespective of whether it is useful or not, practical or theoretical, divorced from the concerns of everyday life or immersed in the market place, provided always that such knowledge is pursued in freedom and at the highest possible intellectual levels. It may be argued that when people like Principal Viriamu Jones at the turn of the century expressed a devoted interest in technical education, what they had in mind was something quite different from technical education as it is understood today. The point has been made that their concern was a practical experimental approach to science rather than that the University should engage in a deliberate effort to collaborate with industry in the training at the advanced levels of those engaged in industry. But is this so? Would the Charter of the University of Wales otherwise have contained provision for the establishment of a University Board of Technology? Article XXVI reads: 'The Court shall on the recommendation of the Council establish a Board to be called the University Board of Technology for the purpose of promoting technological education and research and of conducting inquiries as to the means of improving industrial and commercial processes and shall by Statute prescribe the constitution duties and powers of the said Board.'

There is also provision in the Charter for a Faculty of Technology and in that Faculty for degrees of Bachelor in Technology, Master of Technology and Doctor of Technology. One of the functions under Statute of the Faculty of Technology is 'to advise the Academic Board and the Council on the development of technological education and research in Wales'.

Enough has been said to justify the view that the proposal to seek closer association between the Welsh College of Advanced Technology and the University of Wales is not inconsistent with the aims and intentions of the University as expressed in its Charter and Statutes and that the matter should at any rate be closely examined. That there would be solid advantages from some such association seems to be unquestionable. The status of technical studies in Wales would be enhanced. We think that more students would pursue advanced courses and that more employers would be ready to encourage them to do so. In spite of many personal and administrative difficulties, especially in the early stages of this association, there would undoubtedly be greater economy and efficiency in the disposition of equipment and staff, and students would gain from the more varied and richer teaching that would be available. A further and quite substantial advantage would be that a clearer and more easily recognisable line of demarcation than now exists could be drawn between the College of Advanced Technology and other technical colleges concerned with advanced courses. This would be in turn a step towards a clearer pattern for technical institutions in Wales which has already been touched upon in this Report.

Regionalisation of Advanced Courses

At the beginning of this chapter we state that in certain directions the provision made by local education authorities outruns the demand. Here is an example: During the present session, 1959-60, out of a total of 528 advanced classes conducted at 24 technical colleges in Wales, enrolments in 384 are below the figure which the Ministry in its Administrative Memorandum No. 545 (1st March 1957) considers to be the minimum necessary for the economic and efficient conduct of advanced courses. This, in the face of the shortage of suitably qualified and trained staff to conduct advanced courses and the expensive equipment needed, is to be deplored. Furthermore, in a number of cases two, and even three, classes representing different years of a course are taken together in an attempt to attain the minimum enrolment required. This wasteful and inefficient duplication may well lead to decisions being taken centrally by the Ministry of Education to the detriment of local authority control. Is it unrealistic to expect, in the provision and administration of advanced courses, that the local education authorities should develop a wider outlook and that these matters should be regarded regionally and nationally rather than locally? The machinery for organising these courses regionally exists, since the Welsh Joint Education Committee has the duty to coordinate work at this level, but the problem is far from easy. Local provision, however wasteful it may appear to be, encourages more students; fewer advanced courses would mean more travel for students and more effort in general on their part and therefore fewer students. Local education authorities naturally want to meet to the utmost possible extent the known needs of local students. One possible solution would be to confine advanced courses, especially those of the National Certificate and Diploma type, to a limited number of technical colleges in Wales and provide that these colleges be administered jointly by an Administrative Council. The Administrative Council might be the Technical Sub-Committee of the Welsh Joint Education Committee, or a body appointed by this Sub-Committee consisting of individuals particularly interested in technical education but not necessarily representing specific interests. It would have an independent status and would administer grants from local authorities and the Ministry. It would also appoint governing bodies to each college. As for the number of colleges, we believe that three technical colleges in South Wales —Glamorgan College of Technology, Treforest, Newport and Monmouthshire College of Technology, Newport, and Swansea Technical College—and Denbighshire Technical College, Wrexham, in North Wales, together with the Welsh College of Advanced Technology in Cardiff, would adequately meet the present demand in Wales for advanced courses except those provided by a college specifically for a local industrial concern which can ensure an adequate flow of students. Examples of these are chemical engineering at Neath Technical

College and metallurgy at Flintshire Technical College. With these exceptions we suggest that advanced courses in Wales be confined to the five colleges named above and that these colleges be administered by an Administrative Council as already described.

In the delicate work of regionalisation of advanced courses and the co-ordination, where desirable, of advanced studies at university and technical colleges, it appears to the Council that there is a case for the resuscitation of the Welsh Board of Technology which was set up in 1946 in accordance with the recommendation of the Lord Eustace Percy Committee's Report on Higher Technological Education and which ceased to function after a brief period owing to difficulties in connection with its constitution. It should be emphasised that such a Board would be advisory, but the Council has no doubt that it would have a valuable contribution to make in Wales.

As for the administration of technical colleges generally, governing bodies appointed by local education authorities to assist them administer technical colleges vary from one authority to another in their constitution and in the degree of responsibility delegated to them. The degree of responsibility is usually measured by a governing body's power (a) to spend money within the limits of approved annual estimates without further reference to the authority, and (b) to appoint staff. As for the constitution, some witnesses would give much more control to industrialists, trade unionists and people particularly interested and qualified in technical matters. What the Council is concerned about is that a governing body should consist of the people best qualified irrespective of the interests which they are held to represent. For this reason it would not advocate a fixed proportion of any particular interests and it certainly would not regard it as essential that there should always be a majority of local education authority members on all governing bodies. It should, however, be remembered that ultimate authority lies and should lie with the local education authority.

Summary of Observations and Recommendations

Craft Apprentices

(1) Recruitment to craft apprenticeships tends to be haphazard and to be related to current needs rather than long-term requirements of industry. (*Page* 44.)

(2) There is need to relax the restriction imposed by the Trade Unions on the maximum number of craft apprentices recruited to a given trade. More regard should be paid to overall national quotas. (*Page* 45.)

(3) Many firms in Wales, unable to provide adequate training, do not recruit craft apprentices. With Group Apprenticeship Schemes, as in certain parts of England, a number of these firms would do so. (*Page* 45.)

(4) Despite the strength of family tradition in a craft, blood relationship should not be regarded as a substitute for personal and educational qualifications in recruiting apprentices. (*Page* 45.)

(5) Pupils who remain at school beyond the age of 16 should not be denied the opportunity of obtaining a craft apprenticeship. (*Page* 46.)

(6) The present provision in some technical colleges for pre-vocational training for '15 +' pupils could with advantage be extended to some secondary modern schools, given qualified staff and suitable equipment. (*Page* 46.)

(7) Employers are urged to grant apprentices release with pay to attend technical college courses throughout the period of their apprenticeships, subject to satisfactory progress being made. (*Page* 47.)

(8) Whenever possible block-release courses are preferable to day-release courses. (*Page* 46.)

(9) A distinction should be drawn between the training of the craft apprentice in certain skills and his education which should be designed to make him readily adaptable to master new skills that may later be introduced. (*Page* 43.)

(10) The Preliminary National Certificate and the present first-year stage (S.1) of the National Certificate Course should be abolished, and entry to the course be at what is the present second-year (S.2) stage. The normal entry qualification should be a pass in four appropriate subjects at the General Certificate of Education Ordinary level, these having been gained at not more than two attempts. (*Page*. 47)

(11) Local education authorities, governing bodies and principals of technical colleges should do all in their power to provide short-term courses in teaching methods and to encourage the attendance at such courses of both part-time and full-time teachers at technical colleges who have not pursued teachers' training courses. (*Page* 48.)

(12) Much of the apathetic attitude shown by some students to their studies and which often leads to failure on courses could be eliminated by regular supervision and encouragement of the students in their studies by parents, industry and technical college authorities. (*Page* 49.)

(13). The recent introduction by the City and Guilds of London Institute of additional examinations which demand a lower academic standard and a more practical approach in some craft subjects is welcomed as one means of reducing wastage on craft courses. (*Page* 50.)

(14) The responsibility of recruiting and training craft apprentices is considered a national one, and the establishment of a national craft apprenticeship system is recommended. (*Page* 51.)

(15) An alternative suggestion, if the above is unacceptable, is to reduce the five-year craft industrial apprenticeship to three years, provided that the apprentice recruited by industry at 17-18 years of age has pursued a special two years full-time course in basic subjects. (*Page* 52.)

(16) It is hoped that both industry and the University of Wales will continue to encourage those students who possess appropriate National Certificate qualifications in lieu of normal matriculation requirements to pursue degree courses, particularly in view of the successes gained at the University by some of these students in recent years. (*Page* 22.)

Advanced Courses

(17) Advanced sandwich diploma and university degree courses should become the accepted routes to the status of technologist. (*Page* 54.)

(18) It is to be hoped that the apparent lack of interest in advanced sandwich courses is only temporary, and that all concerned will do all they can to ensure that those capable of benefiting from such courses are encouraged in every possible way to attend. (*Page* 54.)

(19) The lack of support for sandwich courses in chemistry or industrial chemistry in South Wales, where there is a concentration of a variety of chemical industries, is a matter for serious concern. In particular, if the chemical industry did more to encourage the education and training of National Certificate students who show promise, they would need to recruit fewer graduates from universities, and thus indirectly relieve the shortage of graduate science teachers in schools. (*Page* 54.)

Welsh College of Advanced Technology

(20) The lack of support for advanced sandwich courses in science and technology at the College to date creates doubts as to whether the existence of a college of this status in Wales can be justified. Greater cooperation with industry and other technical colleges is needed to ensure better support. (*Page* 55.)

(21) A close association between the College and the University of Wales would enhance the status of technical education in Wales, and is a matter that should be closely examined. (*Page* 56.)

Regionalisation of Advanced Courses

(22) The overall provision in Wales for advanced courses greatly outruns the present demand. To avoid wasteful and inefficient duplication, these courses, for which highly qualified staff and expensive equipment are needed, should be confined to five technical colleges, and these colleges administered by an Administrative Council. (*Page* 57.)

(23) Immediate steps should be taken to resuscitate the Welsh Board of Technology which was formed in 1946 but ceased to function in 1948. (*Page* 58.)

Governing Bodies of Technical Colleges

(24) Governing bodies should consist of the people best qualified for the purpose; therefore, no fixed proportion of any particular interests should be stated and neither should it be regarded essential to have a majority of local education authority members on all governing bodies. (*Page* 58.)

General

(25) The shortage of suitably qualified teachers of science and mathematics in girls' schools restricts the number of girls who study these subjects beyond the elementary stage, and so denies industry the services of many young women who might well qualify as technicians or technologists were they given the opportunity and encouragement to do so. Until more teachers of these subjects become available the possibility of making arrangements between some neighbouring boys' and girls' grammar schools to combine classes at sixth form level should be seriously considered. (*Page* 32.)

(26) Although the introduction of new industries to Wales in the post-war years has done much to strengthen the country's economy, an extension of this diversification to include industries which employ a high proportion of skilled labour is advocated on social as well as economic grounds. (*Page* 32.)

Y WEINYDDIAETH ADDYSG
Y CYNGOR CANOL AR ADDYSG (CYMRU)

Addysg Dechnegol Yng Nghymru

LLUNDAIN
GWASG EI MAWRHYDI
1961

AELODAU'R CYNGOR

*Mr. A. B. Oldfield-Davies, C.B.E. (*Cadeirydd*)

*Y Prifathro G. P. Ambrose
Miss Gwennant Davies
Y Fonesig Twiston Davies
*Dr. G. W. Evans
*Yr Athro C. E. Gittins
Yr Henadur W. Douglas Hughes
Miss A. Whittington-Hughes
Mr. E. O. Humphreys
*Yr Athro D. W. T. Jenkins
Yr Athro J. R. Jones
*Mr. R. G. Mathias
Y Fonesig Hopkin Morris
*Mr. A. J. Nicholas, C.B.E.
Mr. A. D. Rees
*Yr Henadur Mrs. D. M. Rees
Yr Athro E. J. Roberts
*Y Cynghorwr Mrs. G. I. Williams
*Dr. Gordon Williams

Aelodau a gyfetholwyd ar y Panel Technegol

Mr. R. C. Mathias
Mr. Watcyn V. Williams

Ysgrifenyddion

Mr. E. O. Davies, H.M.I.
Dr. W. J. Thomas, H.M.I.

* Aelodau'r Panel Addysg Dechnegol

Bu farw'r Fonesig Twiston Davies, y Fonesig Hopkin Morris a Mr. E. O. Humphreys, tra'r oedd y Cyngor wrthi yn paratoi'r Adroddiad hwn.

MAES YR YMCHWIL

I ystyried pa ddarpariaeth addysg y dylid ei chynnig er budd diwydiant a'r rhai sy'n llafurio ynddo yn wyneb y newid cyfoes ym mhatrwm diwydiannol Cymru.

Rhagair

Gan y Gweinidog Addysg

Y Gwir Anrhydeddus Syr David Eccles, K.C.V.O., A.S.

Caf fod yr Adroddiad hwn yn Adroddiad amserol a diddorol. Gobeithio y bydd i addysgwyr a diwydianwyr Cymru ei gael felly hefyd.

Fe ddylai'r Adroddiad fod yn gymorth i'r colegau a diwydiant ddeall ei gilydd a chydweithio. Bydd hyn o fudd i ieuenctid Cymru a'r wlad yn gyffredinol.

At Y Gwir Anrhydeddus Syr David Eccles, K.C.V.O., A.S.
Y Gweinidog Addysg

Syr,

Gwahoddasoch y Cyngor i ymgymryd â thrafod y darpariaethau addysg gorau ar gyfer gofynion diwydiant yng Nghymru a'r rhai sy'n llafurio ynddo.

Y mae'n bleser gennyf gyflwyno ei Adroddiad ar y mater hwn.

(*Arwyddwyd*) ALUN OLDFIELD-DAVIES (*Cadeirydd*).

Cynnwys

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Rhagarweiniol

Yn yr Adroddiad hwn sy'n ffrwyth ymholiad Panel Addysg Dechnegol Y Cyngor Canol ar Addysg (Cymru), arolygir y ddarpariaeth addysg dechnegol yng Nghymru. Amcanwyd at osodiad ffeithiol ar sail data a restrir mewn tablau yng nghorff yr adroddiad ac mewn atodiadau. Y mae'r bennod gyntaf yn cychwyn gydag arolwg hanesyddol byr a roddwyd i'r Cyngor gan Mr. Gray Jones o Goleg Hyfforddi Caerllion-ar-Wysg a Dr. Roger Webster o Goleg y Brifysgol, Abertawe. Y mae hwn yn pwysleisio bod Cymru wedi bod ar ôl mewn darpariaeth addysg dechnegol o gymharu â Lloegr a bod Prydain Fawr yn gyffredinol wedi bod ar ôl o'i chymharu â llawer gwlad ddiwydiannol arall. Y mae'r amlinelliad byr o batrwm diwydiannol Cymru yn canolbwyntio ar y newid trawiadol a fu yn ein hoes ni. Mae'r newid hwn yn gofyn am addysg dechnegol gyda mwy o amrywiaeth a mwy o ddyfnder ar bob lefel. Sylwir ar y gwahanol lefelau yn ofalus ym Mhennod III, a cheir ym Mhennod IV sylwadau'r Cyngor ar y ddarpariaeth bresennol ynghyd â rhai awgrymiadau go bell-gyrhaeddol.

Nid yw'r Adroddiad yn ei grynswth wedi ei baratoi ar gyfer y darllenydd cyffredin yn gymaint ag ar gyfer y rheini mewn diwydiant, ysgolion, colegau a gweinyddiaeth addysg sydd â chanddynt ofal addysg dechnegol yng Nghymru ac awydd i greu trefn addas i ateb gofynion yr ifanc mewn cyfundrefn fasnachol a diwydiannol sy'n newid ac yn mynd yn fwy-fwy cymhleth o hyd.

Gwyddai'r Cyngor fod y Cyngor Canol ar Addysg (Lloegr) yn ymholi yr un pryd i ofynion addysg rhai rhwng pymtheg a deunaw* oed a bod eu maes hwy, felly, yn cydredeg i raddau â'n maes ninnau yng Nghymru. Ond ni bu cyfathrach rhyngom ac awn ni ymhellach na Chyngor Lloegr trwy awgrymu y dylai hyfforddiant prentisiaid symud fwy-fwy dros amser i faes cyfrifoldeb awdurdodau addysg yn hytrach na pharhau fel y mae yn awr yn gyfrifoldeb diwydiant a sefydliadau proffesiynol. Er i ni ddeall yn iawn na ellir derbyn newid mor fawr yng Nghymru yn unig heb godi'r cwestiwn dros Brydain i gyd, eto credwn fod gofynion Cymru dros hir amser yn hawlio ateb o'r math hwn.

Bu'r Cyngor yn hwy wrth y gwaith nag a ddisgwylid ar y dechrau gan iddo dderbyn dau gyfeiriad oddi wrth y Gweinidog a cheisio trafod y maes hwn pan oedd yn dal i ymholi i addysg cefn gwlad ar gyfer yr adroddiad a gyflwynwyd y llynedd. Dyma hefyd paham nad oes sôn am agweddau amaethyddol addysg dechnegol yma. Aeth peth amser hefyd i drefnu a pharatoi'r ffurf Gymraeg ar yr Adroddiad, ac yr ydym yn ddyledus am hyn yn bennaf i Dr. Gareth Evans, un o aelodau'r Cyngor. Cynorthwywyd ef yn y gwaith gan Mr. Ellis Evans, M.A., o Goleg y Brifysgol, Abertawe.

Diolchwn i bawb a ganiataodd i ni fanteisio ar eu barn a'u gwybodaeth mewn sgwrs neu trwy lythyr. Cawsom gymorth parod diwydianwyr, aelodau awdurdodau addysg lleol, ac athrawon mewn sefydliadau technegol, mewn ysgolion ac yn y Brifysgol. Yr ydym yn hynod ddiolchgar i'r Dr. W. J. Thomas, H.M.I., sydd wedi crynhoi a dethol ffeithiau ac wedi llunio'r adroddiad hwn, i Mr. Eryl O. Davies, H.M.I., am drefnu a chadw cofnodion o'n cyfarfodydd, ac i'r Dr. Matthew Williams, H.M.I., am ateb pob ymholiad o'r eiddom o'i wybodaeth fanwl a'i adnabyddiaeth o'r maes.

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*15 *to* 18, *Report of the Central Advisory Council for Education (England)*. Gwasg ei Mawrhydi, 1959.

PENNOD I

Trem Yn Ôl

O 1750 i 1920, Prydain oedd yn arwain holl wledydd y byd mewn diwydiant a gwaith cynhyrchu. Eto er hyn, ni bu amgyffred teilwng o bwysigrwydd addysg dechnegol hyd gynffon y bedwaredd ganrif ar bymtheg. Er bod yng Nghymru ddiwydiannau trymion, glo a llechi, haearn a metalau eraill a diwydiant brethyn bychan traddodiadol, gosodid llai fyth o bwys ar addysg dechnegol yma. Nid oedd yng Nghymru ganolfannau mawrion megis Leeds, Manceinion, Birmingham a Glasgow. Yn y rhain, ac yn ardaloedd y brethyn a chotwm, y diwydiannau cemegol a pheirianyddol, ac yn Llundain, y tyfodd y godyn am hyfforddiant technegol. Cychwynnwyd dosbarthiadau peirianneg yn Glasgow mor gynnar ag 1840 ac yn Ngholeg y Brifysgol, Llundain yn 1841. Yng Nghymru nid oedd gofyn am fedr technegol ond gan ychydig gemegwyr, mesurwyr pyllau ac arolygwyr peiriannyddol. I'r rhelyw yr oedd hyfforddiant yn y prosesau syml yn ddigonol ac am hir nid oedd eisiau mwy na'r ddawn i drafod gweithwyr hyd yn oed gan y goruchwylwyr a'r trefnwyr.

Dulliau sefydlog anystwyth a lywiai uchel-gynghorau'r gweithiau haearn a'r pyllau glo. Hyfforddwyd eu peirianwyr fel arfer trwy eu gosod yn ddisgyblion dros dro mewn swyddfa gwaith peiriannwr ac yna eu danfon cyn gynted ag yr oedd modd, i loffa profiad o ddydd i ddydd yn y gwaith.* Nid oedd trefniant felly yn esgor ar ddisgyblaeth wyddonol a thechnegol. Rhaid oedd danfon yr ychydig gemegwyr a goruchwylwyr y gweddai'r ddisgyblaeth uwch iddynt i'r Ysgol Fwyngloddio Frenhinol yn Llundain neu i ryw ganolfan tramor.

Er i lawer Sefydliad y Mecanegwyr weld golau dydd yng Nghymru rhwng 1824 a 1850, camgymeriad fyddai tybio iddynt gyfrannu hyfforddiant technegol yn helaeth i'r werin. Ychydig oeddynt yng Nghymru o'i chymharu â Lloegr. Gwyddys fod oddeutu ugain ar gael yn 1851 gyda phedair yn y gogledd, a rhai mewn trefi amaethyddol fel Aberhonddu a Dinbych. Eu pwrpas ar y cyntaf oedd cyflwyno gwybodaeth wyddonol i grefftwyr ond anodd oedd hyn am fod y ddarpariaeth ar gyfer addysg elfennol yn annigonol ddigon yn y cyfnod hwn. Erbyn 1850, y dosbarth canol a'u mynychai ac o ganlyniad symudasant yn fwy-fwy i gyfeiriad adloniant a darlithiau poblogaidd.

Er gwaethaf holl brinder addysg dechnegol ym Mhrydain, a barnu yn ôl safonau y mwyafrif o wledydd y cyfandir, eto yr oedd Arddangosfa Fawr Llundain yn 1851 yn dipyn o glod i ddiwydiant Prydain, canys gwelwyd fod mwyafrif yr arddangosion Prydeinig yn rhagori cryn dipyn ar y rhai tramor. Ond yr oedd rhyw anesmwythyd yn y gwynt gan i rai ddechrau credu y byddai Prydain cyn hir yn sodli'r gwledydd tramor hynny a oedd wedi meithrin addysg dechnegol. Tyfodd gofyn am hyfforddiant technegol i weithwyr; sefydlwyd Adran Gwyddoniaeth a Chelfyddyd De Kensington yn 1853. Gydag amser daeth yr Adran hon yn dra phwysig gan roi grantiau a chynnal arholiadau, a hynny i bob rhyw fath o sefydliad, i ysgolion uwchradd ac elfennol, ysgolion gwyddoniaeth, ysgolion crefft, ysgolion gramadeg, dosbarthiadau nos, sefydliadau'r mecanegwyr, canolfannau disgyblathrawon, a sefydliadau technegol.

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* Felly yr hyfforddwyd Syr W. T. Lewis (yr Arglwydd Merthyr cyntaf) yn swyddfa W. S. Clark, peiriannwr a chynrychiolydd mwyn-gloddio ystâd Bute.

Gyda grantiau De Kensington yn sbardun, cynhaliwyd dosbarthiadau mewn llawer tref Gymreig ond at waith llyfr yn unig yr anelwyd ac anaml y gwelid unrhyw offer. Mynychodd llawer y dosbarthiadau yn unig er mwyn derbyn tystysgrif a agorai'r llwybr iddynt hwy eu hunain gynnal dosbarthiadau tebyg ac ennill arian trwy hynny. Yr oedd diffyg offer hefyd yn nodweddi'r ysgolion elfennol ac uwchradd a agorwyd gan y Byrddau Ysgol yn ôl Deddf Addysg Elfennol 1870. Yr oedd Bwrdd Ysgol Abertawe ar y blaen yn wir yn 1890 pan benododd 'arddangoswr teithiol, galluog a phrofiadol. Dygwyd ei offer o amglych ysgolion y Bwrdd mewn berfa a tho iddi.'

Felly nid rhyfedd mai ychydig ddylanwad ymarferol effeithiol a gafodd Adran De Kensington. Erbyn Arddangosfa Paris in 1867, yr oedd Prydain yn amlwg ar ôl ym mhob adran ymron. Cyfaddefwyd fod rhagoriaeth yr arddangosion tramor ynghlwm wrth ragoriaeth trefn addysg dechnegol a gwyddonol Ewrob ac Unol Daleithiau America.

Brathodd hyn yn ddwfn. Arweiniodd yn union i benodi Comisiwn Devonshire (1870-75). Gwnaeth y Comisiwn arolwg o drefn y dydd mewn hyfforddiant technegol a lledaenodd wybodaeth am ddatblygiadau tramor. Yn sgil y diddordeb newydd hwn, bu gwelliant yn Lloegr. O 1879 ymlaen sefydlodd y *City and Guilds of London Institute* gyfundrefn o arholiadau safonol mewn pynciau crefft a thechneg ac yn 1883 sefydlodd y coleg technegol modern cyntaf yn Finsbury. Yn y flwyddyn hon yr oedd ar gael ysgolion technegol da yn Bradford, Huddersfield a Manceinion. Ysbrydolodd Quintin Hogg sefydlu'r Polytechnic cyntaf yn Regent Street, Llundain. Hefyd yr oedd bellach feistri gwaith llygad-agored fel Mather a Platt a fu'n cynnal eu hysgol dechnegol eu hunain o 1873 i 1903 ac fel Cwmni Brunner Mond a fu'n cefnogi hyfforddiant technegol i'w gweithwyr er 1884. Erbyn hyn yr oedd yr Ysgol Fwyngloddio Frenhinol yn Llundain yn hyfforddi tua 40 o fyfyrwyr y flwyddyn ac yr oedd cyrsiau mewn technoleg gemegol wedi gwreiddio'n gadarn ym Manceinion ac yng Ngholeg y Brifysgol Llundain.

Ychydig ddigon oedd hyn o'i gymharu ag Ysgolion Technegol Uwch llwyddiannus a'r llawer Polytechnic fawr yn Ffrainc, a'r Almaen a'r Swistir. Ond yn ymyl y ddarpariaeth yng Nghymru yr oedd yn llifeiriant. Yng Nghymru nid oedd dim i'w ddangos erbyn 1889 ond llond dwrn o Sefydliadau'r Mecanegwyr, ychydig weithgarwch yn y dosbarthiadau mewn Gwyddoniaeth a Chelfyddyd a rhyw dipyn o weithio yng Nghaerdydd ar gyfer arholiadau'r *City and Guilds*. Ond nid oedd unrhyw addysg dechnegol werth yr enw.

Mae'r dystiolaeth eang a osodwyd gerbron Comisiwn Devonshire yn cadarnhau'r dyfarniad llym hwn. Yn 1871, anfonodd y Comisiynwyr am wybodaeth parthed dysgu gwyddoniaeth mewn tair ysgol waddoledig yng Nghymru sef ym Miwmaris, ac Aberhonddu a Threfynwy. Cawsant ar ddeall nad oedd labordy yn un ohonynt nac ychwaith drefn o hyfforddiant cyson mewn gwyddoniaeth o gwbl.

Yn 1872 tystiodd yr Athro Warrington Smyth o'r Ysgol Fwyngloddio Frenhinol na chynhelid dosbarthiadau mwyngloddio o gwbl yng Nghymru er bod rhai yng Nghernyw ac yn Northumberland. Barnai ef fod cymoedd De Cymru gyda'u mynych ganghennau a'u poblogaeth wasgaredig, yn gwneud trefnu'r fath ddosbarthiadau yn orchwyl anodd. Nid oedd ysgol fwyngloddio na metaleg yn Abertawe; aethai rhai o ddisgyblion De Cymru yr holl ffordd i Ysgol Fwyngloddio Bryste. Yr oedd perchnogion gweithiau toddi metel (copr a sinc) yn dod o hyd i'w rheolwyr ar y cyfandir. Bu raid i Vivian, cawr o ddiwydiannwr o Abertawe, geisio derbyn dynion a hyfforddwyd yn Freiburg yn yr Almaen am nad oedd hyfforddiant digonol yn bod yn Lloegr. Erbyn 1890 yr oedd rhai ar gael o'r Ysgol Fwyngloddio Frenhinol a bu rhyw ddwsin ohonynt yn gweithio fel rheolwyr a chemegwyr yng Nghymru (yng Nglandŵr, Blaenafon, Dowlais, Blaenau, Fflint ac Abertawe). Ni chymerai perchnogion y glofeydd fel arfer unrhyw ddiddordeb o gwbl mewn addysg dechnegol bwrpasol i'r glofeydd, ac ni ddaeth unrhyw gymorth oddi wrthynt hwy.

Barnodd Lionel Brough, Arolygwr Pyllau ei Mawrhydi, ac un arall a dystiodd gerbron Comisiwn Devonshire, y gellid agor ysgol fwyngloddio ym Merthyr ar gyfer poblogaeth o gan mil. Yr oedd hyn wedi ei awgrymu lawer tro ond ni ddigwyddodd dim. Byddai'r arian a gollwyd trwy ddamweiniau wedi bod yn ddigon i glirio'r gost, heb sôn am y bywydau a gollwyd. Yr oedd y pyllau newydd dyfnach yn codi problemau arbennig o awyru a datblygu a hawliai wybodaeth dechnegol nas ceid hyth drwy gyfnod o brentisiaeth mewn swyddfa gwaith peiriannwr.

Dywedodd trydydd tyst fod Ysgol Fwyngloddio Bryste eisoes wedi gorfod cau oherwydd diffyg cefnogaeth perchnogion y glofeydd ond bod gwaith yr ysgol yn mynd yn ei flaen mewn dosbarth mwyngloddio yn ei ysgol ef sef y *Bristol Trade School.* Yr oedd llawer o'r disgyblion yno o Dde Cymru. Yr oedd ef ei hun newydd fod yn cymeradwyo sefydlu ysgol fwyngloddio yn Ne Cymru mewn papur a ddarllenodd gerbron y *South Wales Institute of Mining Engineers* gyda Syr W. T. Lewis yn y gadair. Croesawyd yr awgrym ond mewn gwirionedd nid agorwyd yr Ysgol Fwyngloddio gyntaf yng Nghymru yn Nhrefforest tan 1910, bron ddeugain mlynedd yn ddiweddarach.

Yn wyneb hyn oll, nid rhyfedd nad oes gyfeiriad at addysg dechnegol yng Nghymru yn adroddiadau cynhwysfawr Comisiwn Brenhinol arall ar Hyfforddiant Technegol yn 1884. Rhaid fuasai i welliant yng Nghymru ddilyn datblygiad mewn addysg uwchradd a oedd yn dal i fod ar ôl. Amhosibl fuasai trefnu addysg uwchradd neu addysg dechnegol ar raddfa genedlaethol cyn creu yn gyntaf gyfundrefn o awdurdodau lleol. O'r diwedd sefydlwyd y Cynghorau Sir a'r Cynghorau Bwrdeisdrefi Sir yn 1888 ac yn dilyn yn 1889 daeth Deddf Hyfforddiant Technegol a Deddf Addysg Dechnegol Ganolradd Cymru. Rhoddodd y ddeddf gyntaf i'r Cynghorau newydd mewn Sir a Bwrdeisdref, awdurdod i godi treth er mwyn datblygu addysg dechnegol. Sicrhaodd yr ail ddeddf gyfundrefn genedlaethol o ysgolion uwchradd gyda maes llafur a fwriadai gyfuno addysg draddodiadol ysgolion gramadeg ar y naill law ac addysg dechnegol a gwyddonol fodern ar y llaw arall. A chan gredu y byddai'r cyfuniad yn effeithiol, neilltuodd y Cynghorau Cymreig elw treth y ddeddf gyntaf ar gyfer yr ysgolion uwchradd. Fodd bynnag, yn ymarferol, er i ddysgu gwyddoniaeth a gwaith coed gael sylw mewn rhai ysgolion uwchradd, ni bu nemor ddim addysg dechnegol. Yr oedd mwy fri ar addysg draddodiadol academiadd ac i raddau yr oedd hefyd ddiffyg cyflenwad o athrawon cymwys mewn techneg. Felly, yn ymarferol, tagwyd datblygiad addysg dechnegol.

Pen-conglfaen adeiladu y gyfundrefn addysg genedlaethol hon oedd sefydlu Prifysgol Cymru yn 1893. Gallai myfyriwr galluog, a bwrw ei fod yn dod o hyd i adnoddau ariannol, symud o ysgol elfennol i ysgol ganolradd ac yna i brifysgol. Ond gyrfa i fyfyriwr academaidd ei osgo oedd hon yn hytrach na llwybr i'r person â'i fryd ar addysg dechnegol. Ceisiodd Viriamu Jones, F.R.S., Prifathro cyntaf Coleg Caerdydd, yn galed addasu'r cyfle newydd i ateb gofynion addysg dechnegol. Credai'n gryf mewn addysg wyddonol mewn ysgolion Uwchradd; O Goleg Firth, Sheffield, y daeth ohono i Gaerdydd yn 1883, rhoddodd dystiolaeth gerbron y Comisiwn Brenhinol ar Hyfforddiant Technegol gan bwyso ar frys am ddatblygu addysg dechnegol mewn cysylltiad agos â'r colegau prifathrofaol newydd. Naturiol, felly, oedd i gynghorau'r siroedd â'r bwrdeisdrefi droi ato ef am gyfarwyddyd. Ei gyngor ef a lywiodd ddatblygiad addysg dechnegol am yr ugain mlynedd nesaf ac a bwysleisiodd yn barhaus y berthynas â'r brifysgol.

Yn 1886 yr oedd ef eisoes wedi peri danfon dirprwyaeth o'r Coleg yng Nghaerdydd at Arglwydd Lywydd y Cyngor i bwyso am Gadair Peirianneg. Methodd y cais ond cynigiwyd yr arian ar ei chyfer gan Gwmni'r Brethynwyr yn 1890. Dyma'r cam sicr cyntaf tuag at addysg dechnegol uwch yng Nghymru.

Dan gyfarwyddyd Deddf 1889, ffurfiodd Cyngor Bwrdeisdref Caerdydd Bwyllgor i fod yn gyfrifol am ddosbarthiadau gwyddoniaeth a chelfyddyd, dosbarthiadau y bu Pwyllgor y Llyfrgelloedd yn gyfrifol amdanynt tan hynny. Cychwynnwyd y dosbarthiadau yn 1866 a chynhaliwyd hwy yn y Llyfrgell Gyhoeddus er 1882. Gelwid y pwyllgor newydd yn Bwyllgor Hyfforddiant Technegol. Ei gam cyntaf oedd holi am delerau'r Coleg am dderbyn y cyfrifoldeb o lywio ac anheddu'r ysgolion technegol a'r dosbarthiadau a nodwyd uchod. Canys cyngor y Prifathro cyn hyn fu mai'r Coleg a ddylai gynnig addysg dechnegol yn hytrach na sefydliad newydd-sbon.

Cytunwyd i gadw dosbarthiadau nos o fewn muriau'r Coleg ac y byddai Prifathro a Chofrestrydd y Coleg yn gweithredu hefyd fel Prifathro ac Ysgrifennydd yr Ysgol Dechnegol. Dyna'r drefn hyd 1907, blwyddyn penodiad Goruchwyliwr Hyfforddiant Technegol gan Awdurdod Addysg Lleol Caerdydd. Erbyn hyn cynhelid y dosbarthiadau nos yn *Dumfries Place* ac o'r diwedd, yn 1916, adeiladwyd y Coleg Technegol.

Aeth Cynghorau Morgannwg, Mynwy a Chaerfyrddin hwythau yn eu tro at Viriamu Jones am gyfarwyddyd. Yn unol â'i gyngor, penodasant am yr ugain mlynedd nesaf, hyfforddwyr teithiol i gynnal dosbarthiadau nos a gwaddolasant efrydiaethau technegol yn y Coleg. Yr oedd y Prifathro o hyd â'i fryd ar sefydlu Ysgol Fwyngloddio ac Adran Fetaleg yn y Coleg.

Yn Abertawe trefnwyd cadw'r dosbarthiadau nos yn yr ysgol ramadeg o dan reolaeth y prifathro yn 1896. Felly y bu tan 1907 pryd y codwyd adeilad technegol newydd i gynnal dosbarthiadau dydd yn ogystal â rhai nos.

Coleg technegol cyntaf awdurdod addysg lleol Cymreig oedd Coleg Technegol Casnewydd, lle'r unwyd dosbarthiadau Gwyddonol a Thechnegol a'r dosbarthiadau yn y Celfeddydau o dan yr un tô yn 1910.

Felly erbyn diwedd y ganrif yr oedd dosbarthiadau nos, dan ofal hyfforddwyr rhan amser neu deithiol, wedi eu sefydlu yn gyffredinol yn ardaloedd diwydiannol y De. Yr oedd Coleg y Brifysgol yng Nghaerdydd, trwy ddarpariaeth mewn ffiseg, cemeg a pheirianneg, yn ateb galwadau'r myfyrwyr mwyaf aeddfed a allai ennill efrydiaethau technegol. Yr oedd hefyd yn tyfu ysgolion uwchradd a roddai sylw digonol i wyddoniaeth, er eu bod yn academaidd eu hosgo yn y bôn.

Y gwendidau pennaf oedd diffyg cyrsiau cyfunedig, y dosbarth nos fel yr unig gyfrwng, y prinder athrawon technegol wedi eu hyfforddi i'r gwaith, a'r methiant llwyr i godi adeiladau modern addas. Nid oedd gobaith symud y rhwystrau hyn heb ail wampio trefn weinyddol addysg. Gwnaethpwyd hyn drwy ffurfio'r Bwrdd Addysg yn 1899, a'r awdurdodau addysg lleol yn 1902. Pwrpas y cyntaf oedd cyfnerthu gweinyddu addysg genedlaethol drwy beri i'r Bwrdd gymryd at waith yr Adran Gwyddoniaeth a Chelfyddyd a gwaith y *Charity Commissioners* i'r graddau yr oedd a fynnont ag addysg. Pwrpas yr ail oedd rhoi undod a chyfanrwydd i weinyddiad lleol addysg dros yr holl wlad. O hyn allan bu'r wybren yn fwy clir.

Cychwyniad a Thyfiant Sefydliadau a Cholegau Technegol

Fel y gwelwyd eisoes agorwyd sefydliadau technegol yng Nghasnewydd, yn Abertawe ac yng Nghaerdydd rhwng 1910 a 1916, a sefydlodd Cymdeithas Perchnogion Pyllau Glo De Cymru ysgolion mwyngloddio yng Nghrymlyn ac yn Nhrefforest. Erbyn 1919-20 yr oedd 840 a fyfyrwyr amser-llawn a 6,339 o fyfyrwyr rhan-amser yn y rhain. Yr oedd 48,829 o fyfyrwyr yn mynychu 631 o ysgolion nos, gan mwyaf yn adeiladau'r ysgolion dyddiol. Cychwynnwyd sefydliad technegol yn Wrecsam yn 1927. Cymerodd Awdurdodau Addysg Morgannwg a Mynwy at Ysgolion Trefforest a Chrymlyn i'w cynnal fel sefydliadau technegol.

Rhwng 1929 a 1939 ymledodd addysg bellach ran-amser i nifer o ganolfannau ychwanegol. Cododd awdurdodau addysg lleol sefydliadau mwyngloddio a thechnegol yn y meysydd glo gyda chymorth *grantiau* o Gronfa Les y Glowyr. Deddf Diwydiant Mwyngloddio 1920 a barodd godi'r Gronfa hon a hynny er mwyn gwella amgylchiadau gweithwyr y diwydiant o ran addysg, bywyd cymdeithasol ac adloniant. Cyfrifoldeb yr awdurdodau addysg oedd cynnal y sefydliadau hyn, a'u staff hefyd. Eu hystâd fel arfer oedd dwy ystafell ddosbarth, dau lahordy i wyddoniaeth a swyddfa luniadu. Yn eu dyddiau cynnar eu nod oedd gwella hyfforddiant technegol uwch gweithwyr y pyllau gan gynnwys paratoi ar gyfer arholiad Tystysgrif Goruchwylwyr Pyllau, arholiadau a bennwyd gan y ddeddf. Gan mai ychydig o'r gwaith hwn a wneid liw dydd, cychwynnwyd ysgolion technegol cynradd yn y sefydliadau ar gyfer rhai rhwng tair-ar-ddeg a phymtheg oed. (Gweler tudalen 87.)

Ganol y tridegau yr oedd rhyw ddwsin mewn bod ac ehangwyd rhai trwy godi rhagor o weithdai ac o ystafelloedd dosbarth. Hwynthwy fu cnewyllyn llawer o'n colegau technegol presennol.

Dangosir cynnydd nifer eu myfyrwyr rhwng 1927 a 1938 yn y tabl canlynol:

Blwyddyn	Cyrsiau Amser-llawn i rai hŷn		Cyrsiau Technegol Dydd		Dosbarthiadau Nos	
	Canolfannau	Myfyrwyr	Canolfannau	Myfyrwyr	Canolfannau	Myfyrwyr
1927-28 ...	4	589	13	1,604	635	48,831
1929-30 ...	4	608	10	1,656	724	57,742
1931-32 ...	5	585	10	1,701	795	58,201
1933-34 ...	5	765	11	1,599	794	54,368
1935-36 ...	5	756	13	1,527	814	55,729
1937-38 ...	5	795	16	2,029	885	64,265

Sefydlu Cyrsiau'r Dystysgrif Genedlaethol a'r Ddiploma Genedlaethol

Yn 1921 trefnwyd i Sefydliad y Peirianwyr Mecanyddol mewn cyd-ddealltwriaeth â'r Bwrdd Addysg, gyflwyno Tystysgrif a Diploma mewn Peirianneg Fecanyddol, y Dystysgrif ar ôl llwyddiant mewn cwrs rhan-amser a'r Ddiploma am gwrs amser-llawn. Bu trefniant tebyg mewn cemeg. O'r camau hyn y tyfodd cynllun y Dystysgrif a'r Ddiploma Genedlaethol sydd wedi chwarae rhan mor bwysig mewn addysg dechnegol.

Cynigir y Dystysgrif Genedlaethol Gyffredinol (*Ordinary National Certificate, O.N.C.*) am lwyddiant mewn cwrs tair blynedd rhan-amser. Caniateir cwtogi'r amser os bydd gan ymgeisydd ryw gymhwyster neilltuol megis Tystysgrif lefel Gyffredin neu lefel Uwch y Dystysgrif Addysg Gyffredinol (*G.C.E.*). Felly ni bydd yn rhaid i fyfyriwr ddilyn blwyddyn gyntaf y cwrs, ac weithiau yr ail flwyddyn hefyd, am resymau fel y rhain. Ar y llaw arall, rhaid i fyfyriwr sydd heb gymwysterau digonol ddilyn cwrs rhag-baratoawl. Cyn yr ail ryfel byd cyrsiau nos oedd y rhain gan mwyaf yn rhedeg am dair noson o'r wythnos i bob myfyriwr. Ond, wedi'r rhyfel, newidiwyd bron yn llwyr i gyrsiau dydd (cyrsiau rhyddhad dydd, *day-release courses*), a rhyddheir y myfyrwyr o'u gwaith am un dydd o'r wythnos i'w mynychu. Dilynir hwy gan gwrs rhan-amser yn estyn dros ddwy flynedd ar gyfer y Dystysgrif Genedlaethol Uwch (*Higher National Certificate, H.N.C.*).

Y mae'r cyrsiau cyfatebol ar gyfer y Ddiploma Genedlaethol Uwch yn gofyn chwe mis neu fwy y flwyddyn o waith amser-llawn mewn coleg technegol. Dwy flynedd yw hyd cwrs y Ddiploma Gyffredinol ac y mae'r Ddiploma Uwch yn gofyn tair blynedd yn ychwanegol. Gan fod mwy o amser wrth law, mae cynnwys cwrs y Ddiploma yn fwy na chynnwys y Dystysgrif ac y mae'r safon yn uwch hefyd.

Llunnir y meysydd llafur yn y lle cyntaf gan y coleg technegol sydd yn cynnig y cwrs, gan roi sylw teg i ofynion diwydiant lleol. Yna rhaid wrth gymeradwyaeth y Bwrdd Addysg a'r corff proffesiynol perthnasol. Er 1954, y mae'r Cyd-bwyllgor Addysg Cymreig wedi gweithredu fel Corff Arholi Rhanbarthol ar gyfer rhai Tystysgrifau Cenedlaethol Cyffredinol ac erbyn hyn y mae colegau technegol Cymru bron i gyd wedi dewis derbyn trefniant y Cyd-bwyllgor yn hytrach na dyfeisio eu cynlluniau eu hunain.

Yn wahanol i'r rhan fwyaf o gymwysterau tebyg, y mae dyfarnu'r Tystysgrifau a'r Diplomâu Cenedlaethol yn dibynnu nid yn unig ar waith arholiad ond hefyd ar safon gwaith fel yr adlewyrchir hynny gan y marciau a enillir am waith cartref a gwaith dosbarth ac ar safon foddhaol presenoldeb. Trefnir arholiadau ar ben pob blwyddyn ac ni chaiff myfyriwr fynd ymlaen i gwrs y flwyddyn nesaf heb iddo yn gyntaf gwpláu gwaith y flwyddyn flaenorol yn foddhaol yn yr arholiad, yn safon ei waith o ddydd i ddydd, ac mewn presenoldeb.

Gan fod y Weinyddiaeth a chorff proffesiynol gyda'i gilydd yn cyd-reoli'r drefn hon, y mae'r safon yn sicr o ran addysg ac o ran safonau proffesiynol. Derbynnir y Dystysgrif a'r Ddiploma Uwch gan lawer corff proffesiynol fel rhan o gymhwyster teilwng o aelodaeth ohonynt.

Nodir yma rai o'r cyrsiau cyntaf a gynhaliwyd yng Nghymru. Yn Ionawr 1922 cadarnhawyd Cwrs Ddiploma Genedlaethol Gyffredinol mewn peirianneg fecanyddol yng Ngholeg Technegol Caerdydd, a dau gwrs, un ar gyfer y Ddiploma Gyffredinol a'r llall ar gyfer y Dystysgrif Gyffredinol yng Ngholeg Technegol Casnewydd a hefyd yn yr un flwyddyn Gwrs Tystysgrif Gyffredinol mewn peirianneg fecanyddol yng Ngholeg Technegol Abertawe. Cydnabuwyd Cyrsiau Tystysgrif a Ddiploma yn Ysgolion Mwyngloddio Trefforest a Chrymlyn tua diwedd 1920.

Yn y tabl isod dangosir nifer y rhai a fu'n llwyddiannus yn sefydliadau Cymru hyd at 1937-38:

Blwyddyn	Peirianneg Fecanyddol				Peirianneg Drydanol				Adeiladu		Cemeg	
	T.G.G.	T.G.U.	D.G.G.	D.G.U.	T.G.G.	T.G.U.	D.G.G.	D.G.U.	T.G.G.	T.G.U.	T.G.G.	T.G.U.
1923-24	4 (10)	—	3 (6)	—	—	—	—	—	—	—	—	—
1924-25	12 (16)	—	7 (14)	—	—	—	—	—	—	—	—	—
1925-26	7 (14)	—	10 (13)	—	1 (2)	—	—	—	—	—	2 (2)	—
1926-27	19 (23)	—	11 (14)	—	2 (3)	—	—	—	—	—	3 (4)	—
1927-28	8 (19)	—	14 (18)	—	—	—	—	—	—	—	2 (2)	—
1928-29	4 (10)	3 (3)	9 (14)	—	5 (5)	2 (2)	—	—	—	—	3 (6)	—
1929-30	8 (9)	4 (4)	11 (14)	—	9 (10)	1 (1)	—	—	—	—	1 (6)	—
1930-31	19 (22)	—	15 (21)	3 (5)	9 (12)	3 (5)	—	—	11 (16)	5 (7)	2 (3)	—
1931-32	14 (19)	—	10 (12)	2 (3)	11 (16)	7 (7)	—	—	7 (11)	—	4 (5)	—
1932-33	15 (20)	10 (12)	11 (16)	3 (3)	12 (19)	4 (6)	—	—	5 (10)	6 (7)	2 (4)	—
1933-34	6 (10)	7 (8)	14 (17)	3 (3)	20 (22)	5 (7)	4 (9)	—	9 (12)	1 (3)	3 (6)	4 (5)
1934-35	9 (15)	4 (5)	25 (31)	1 (1)	14 (20)	7 (12)	—	—	16 (18)	3 (3)	1 (4)	1 (2)
1935-36	10 (16)	6 (6)	9 (13)	2 (3)	24 (30)	8 (10)	6 (9)	—	12 (20)	7 (10)	6 (7)	1 (1)
1936-37	12 (23)	5 (5)	10 (11)	—	25 (40)	7 (10)	7 (9)	—	14 (17)	7 (9)	2 (7)	—
1937-38	26 (33)	6 (7)	6 (14)	4 (5)	24 (50)	3 (7)	5 (12)	—	16 (18)	6 (8)	7 (10)	4 (6)

(Dengys y ffigurau mewn cromfachau gyfanrif yr ymgeiswyr.)

Y mae'r cynnydd rhwng 1934 a 1938 yn nifer y T.C.C., sef o 10 i 33 mewn Peirianneg Fecanyddol ac o 22 i 50 mewn Peirianneg Drydanol, yn arwydd o dyfiant diwydiant yng Nghymru yn ail hanner y tridegau. A thebyg bod y cwymp yn nifer ymgeiswyr y Dystysgrif mewn Peirianneg Fecanyddol, o 22 i 15 rhwng 1931 a 1934, a chynnydd cyfatebol o 21 i 31 yn nifer ymgeiswyr y Ddiploma, yn arwydd o gynnydd diweithdra ar ddechrau'r tridegau.

Y Cyrsiau Rhyngosod Cyntaf

Dyma'r enw a osodir ar y math hwnnw o gwrs lle y treulia'r myfyriwr gyfnodau o amser, chwe mis fel rheol, mewn coleg technegol ac mewn diwydiant bob yn ail. Y cyntaf o'r fath yng Nghymru oedd Cwrs y *Joint Mining Diploma*, a ymestynnai dros dair blynedd, ac a gynhaliwyd yn Ysgol Fwyngloddio Trefforest gyda chydweithrediad Coleg y Brifysgol Caerdydd. Dechreuwyd cynnal y cwrs hwn pan agorwyd yr Ysgol Fwyngloddio yn 1913. Hefyd cychwynnwyd dau gwrs rhyngosod o bedair blynedd, un yn 1913 yn arwain i Ddiploma Beirianneg Pwll yr Ysgol Fwyngloddio a'r llall yn 1917 ar gyfer Ddiploma Beirianneg Gemegol yr un Ysgol. Cynhaliwyd cyrsiau rhan-amser rhyddhad dydd i fesurwyr pyllau, mecanegwyr, trydanwyr a chemegwyr yn yr Ysgol o 1913 ymlaen.

Cyd-bwyllgor Ymgynghorol De Cymru a Mynwy ar Addysg Mewn Mwyngloddio

Yn dilyn adroddiad 1924 y Bwrdd Addysg ar hyfforddiant gweithwyr glo De Cymru a Mynwy, ffurfiwyd y pwyllgor ymgynghorol hwn yn 1925. Hwn oedd y cyntaf o'i fath yn y Deyrnas Unedig ac un o'i gyfraniadau gwerthfawr oedd creu un drefn gyffredinol ar gyfer addysg fwyngloddio ym Maes Glo'r Deheudir. Bu'r pwyllgor mewn bod tan 1938, pryd aeth yn is-bwyllgor i'r Cyngor Ymgynghorol a nodir isod.

Y Cyngor Ymgynghorol ar Addysg Dechnegol yn Ne Cymru a Mynwy

Ganed hwn yn 1935—yn dilyn awgrym mewn adroddiad arall gan y Bwrdd Addysg yn 1931 ar 'Broblemau Addysg Maes Glo De Cymru.' Sylwodd yr adroddiad ar nychdod masnach allforio glo De Cymru ac ar ymfudo'r boblogaeth o'r fro. Awgrymodd y dylid cynnal addysg dechnegol dros faes mwy eang a chodi safon yr addysg honno er mwyn delio â'r sefyllfa newydd hon. Ffurfiwyd y Cyngor Ymgynghorol i sicrhau cysylltiad agosach rhwng addysg, diwydiant a masnach, gwell cydweithrediad rhwng awdurdodau lleol ac i roi pen ar wastraff ac annigonolrwydd y ddarpariaeth addysgol.

Dyma grynodeb o ffrwyth llafur y Cyngor hwn:

paratoi nifer o gyhoeddiadau dros faes eang ynglŷn ag addysg dechnegol i fod yn arweiniad i Bwyllgorau Addysg, swyddogion, athrawon, myfyrwyr a diwydianwyr;
sefydlu cyfundrefn o arholiadau, gyda chymedrolwyr allanol, ar gyfer cyrsiau rhagbaratoawl rhan-amser yn y colegau technegol a hefyd ar gyfer myfyrwyr ysgolion technegol iau.
cadw cysylltiad defnyddiol â diwydiant ar fater hyfforddi gweithwyr;
hel rhoddion ariannol gwerthfawr i gynnal ysgoloriaethau a gwaddoli gwobrau i fyfyrwyr, ac i weinyddu'r cynllun;
dwyn perswâd ar ddiwydianwyr er hwyluso rhyddhad dydd i weithwyr er mwyn iddynt allu dilyn dosbarthiadau technegol;
cadw cysylltiad gwahanol adrannau'r llywodraeth a chyrff eraill megis y *City and Guilds of London Institute*, yr undebau arholi rhanbarthol, y cyrff proffesiynol a Chymdeithas Ddiwydiannol Cymry a Mynwy;
hel ystadegau a sicrhau sylw yn y wasg trwy'r wlad i lawer o agweddau ar addysg dechnegol;
bod yn fan cyfarfod i gynrychiolwyr awdurdodau addysg lleol, swyddogion, athrawon, diwydianwyr, undebau llafur ac adrannau'r llywodraeth.

Y Cyngor Ymgynghorol ar Addysg Dechnegol yng Ngogledd Cymru

Er bod sôn am Gyngor tebyg i warchod buddiannau Gogledd Cymru yn y blynyddoedd cyn yr ail ryfel byd, ni sefydlwyd y Cyngor tan 1944. Yn ei oes fer, bu'n mesur yr angen am addysg a'r cynlluniau a oedd mewn bod i ddiwallu'r angen hwn. Cyhoeddwyd y ffeithiau ynghyd ag awgrymiadau'r Cyngor er gwella'r sefyllfa mewn adroddiad yn 1947.

Bwrdd Academaidd Cymru mewn Technoleg

Gan ddilyn awgrymiadau cyngor Arglwydd Eustace Percy ar Addysg Dechnegol Uwch yn 1945, awgrymodd y Gweinidog Addysg fod y ddau Gyngor Ymgynghorol yn y De a'r Gogledd a'r Brifysgol yn sefydlu rhyngddynt Fwrdd arall. Ei bwrpas fyddai rhoi cyngor ar holl faterion datblygu a chydgysylltu astudiaethau technegol uwch yng ngholegau'r Brifysgol ac yn y colegau technegol. Felly ffurfiwyd y Bwrdd yn 1946 ac yn ystod ei eisteddiad cyntaf ar y cyntaf o Orffennaf, penderfynwyd sefydlu Is-bwyllgorau Academaidd i ystyried gofynion addysgol uwch y diwydiannau a ganlyn: peirianneg (mecanyddol, trydanol a sifil); peirianneg gemegol a thechneg tanwydd; mwyngloddio; metaleg; adeiladu; masnach. Cyhoeddwyd adroddiad yn 1948 yn cynnwys argymhellion yr Is-bwyllgorau, ac erbyn hyn, gosodwyd llawer ohonynt ar waith.

Y Cyd-bwyllgor Addysg Cymreig

Yn 1948 derbyniodd y Gweinidog Addysg argymhellion Gweithgor a fu'n ystyried problemau gweinyddiaeth addysg yng Nghymru er 1946. Ffurfiwyd y Cyd-bwyllgor Addysg Cymreig drwy uno'r Bwrdd Canol Cymreig (a sefydlwyd yn 1896), Ffederasiwn Pwyllgorau Addysg (Cymru a Mynwy) a'r Cynghorau Ymgynghorol ar Addysg Dechnegol yn y De a'r Gogledd. Cyfarfu'r Pwyllgor newydd ar Hydref 1, 1948 am y tro cyntaf.

Derbyniodd y Pwyllgor newydd hwn gyfrifoldeb y ddau cyngor Ymgynghorol Technegol a chryn dipyn o eiddo'r Bwrdd Academaidd mewn Technoleg canys mae rhan 12(i) o Orchymyn y Gweinidog Addysg, yn yr is-rannau (c) a (d) yn darllen fel a ganlyn:

> '12(i) Bydd i'r Cynghorau a fydd yn penodi'r Pwyllgor drosglwyddo i sylw'r Pwyllgor y materion canlynol:—
>
> (c) darparu colegau addysg bellach gan gynnwys yn arbennig golegau'r celfyddydau a cholegau addysg oedolion;
>
> (d) cyd-gysylltu darpariaeth addysg bellach.'

Er i Ysgrifennydd Seneddol y Gweinidog Addysg yn ei anerchiad agoriadol i'r Cyd-bwyllgor ddatgan a ganlyn, 'Sicr wyf yr hoffech i mi hefyd ddatgan gobaith y Gweinidog y bydd i Fwrdd Academaidd Cymru mewn Technoleg ddal i fod yn ddolen gydiol effeithiol rhwng Prifysgol Cymru â'r Pwyllgor hwn'—eto nid felly y bu canys darfu'r Bwrdd Academaidd yn fuan ar ôl hyn oherwydd diffyg cyd-ddealltwriaeth ynglŷn â'i gyfansoddiad.

Tyfiant Colegau Technegol ar ôl y rhyfel

Yn y tridegau ehangwyd adeiladau Colegau Technegol Caerdydd ac Abertawe ac erbyn 1939 yr oedd pymtheg o sefydliadau mwyngloddio a thechnegol yn cynnal cyrsiau dydd a chyrsiau nos, ar wahân i'r pum coleg mawr yng Nghaerdydd, Crymlyn, Casnewydd, Abertawe a Threfforest. Yn union wedi'r rhyfel, bu cynnydd mawr yn holl feysdd addysg dechnegol a barodd anawsterau llym ynglŷn â lle a llety a bu raid i'r colegau wynebu'r broblem o ehangu'n sylweddol. Ond oherwydd y wasgfa ar adnoddau adeiladu yn union ar ôl difrod y rhyfel, ni ddechreuwyd ar raglen ymhelaethu sefydliadau addysg dechnegol hyd 1949. Ers hynny fodd bynnag bu symud diflino i ateb y gofyn am ragor o addysg dechnegol. Rhwng 1949 a 1958 codwyd 14 coleg newydd ar draul o £3,270,000 (heb gynnwys offer) a gwariwyd £1,145,000 ar helaethu y tri sefydliad ar ddeg a oedd eisoes yn bod. Yn 1959, yr oedd pum coleg newydd ychwanegol a gwaith helaethu pedwar arall yn nwylo'r adeiladwyr. Yn sesiwn 1959-60, yr oedd ar gael 45 o brif sefydliadau addysg bellach. Rhoir manylion amdanynt yn atodiad F.

Y Cynnydd yn Nifer yr Athrawon mewn Sefydliadau Addysg Bellach wedi'r Rhyfel

Yn ogystal â darparu lle ac offer, rhaid oedd wrth athrawon cymwys i gynnal y colegau. Dengys y tablau a ganlyn y cynnydd rhwng 1947 a 1957 yn nifer athrawon prif sefydliadau addysg bellach Cymru.

Athrawon Amser Llawn

Blwyddyn	Meibion	Merched	Cyfanrif
1947	179	26	205
1957	643	72	715

Athrawon Rhan-Amser

Blwyddyn	Meibion	Merched	Cyfanrif
1947	355	74	429
1957	1,122	252	1,374

Y Cynnydd Yng Ngwaith Sefydliadau Addysg Bellach wedi'r Rhyfel

Y mae ystyr arbennig i'r ymadrodd prif sefydliadau addysg bellach. Sefydliadau a cholegau technegol ydynt lle y darperir cyrsiau dydd a chyrsiau nos neu gyrsiau dydd yn unig. Gelwir hwy yn Golegau Technolegol, yn Golegau Technegol neu yn Golegau Addysg Bellach yn ôl safon a natur eu gwaith. Mae'r gwaith bron i gyd yn ymwneud â galwedigaeth arbennig y myfyriwr. Hefyd y mae sefydliadau nos lle y darperir dosbarthiadau sydd ar y cyfan yn adloniadol neu ddiwylliannol eu naws; cynhelir y rhain mewn ysgolion cynradd ac uwchradd, mewn Neuaddau a mewn Capeli. Yn 1938 yr oedd 885 o sefydliadau nos yng Nghymru gyda 64,365 o fyfyrwyr. Erbyn 1958, cododd y nifer i 1,362 gyda 83,474 o fyfyrwyr.

Dengys y tabl canlynol y cynnydd yn nifer myfyrwyr y prif sefydliadau addysg bellach rhwng 1947 a 1958.

Blwyddyn	Nifer y Sefydliadau	Myfyrwyr Amser-Llawn		Myfyrwyr dydd Rhan-amser		Myfyrwyr Nos		*Cyfanrif Myfyrwyr		*Cyfanrif
		Meibion	Merched	Meibion	Merched	Meibion	Merched	Meihion	Merched	
1946-47	34	879	590	7,087	801	13,060	6,752	21,026	8,143	29,169
1947-48	37	1,011	592	8,351	1,011	16,476	9,625	25,838	11,228	37,066
1948-49	36	1,152	579	10,003	1,189	15,787	9,795	26,942	11,563	38,505
1949-50	38	1,108	655	10,625	1,607	16,921	9,804	25,122	11,793	36,915
1950-51	37	1,110	692	12,268	1,694	18,495	10,816	27,143	12,952	40,095
1951-52	39	955	695	13,791	1,536	18,442	8,826	27,207	10,768	37,975
1952-53	42	937	881	15,758	1,544	19,180	9,645	29,139	11,751	40,890
1953-54	43	797	1,126	16,952	1,599	21,148	9,718	30,982	12,015	42,997
1954-55	46	878	1,284	18,135	2,107	23,417	10,244	32,866	13,248	46,114
1955-56	45	1,058	1,550	19,189	2,442	23,919	11,687	34,777	15,092	49,869
1956-57	45	1,511	1,727	21,616	2,609	25,712	11,736	38,408	15,315	53,723
1957-58	46	1,960	1,853	21,920	2,630	25,431	10,271	38,603	14,004	52,607

* Er 1949-50, cyfrifir y rhai sy'n mynychu dosbarthiadau dydd a rhai nos yn yr un sefydliad un waith yn unig ac nid ddwywaith.

Yn 1957-58, yr oedd 139,602 o fyfyrwyr yn derbyn grant ar gyfer mynychu sefydliadau addysg bellach yng Nghymru, gan gynnwys y prif sefydliadau, sefydliadau celfyddyd a sefydliadau min nos. Yn 1937-38, y nifer oedd 67,089.

Rhwng 1950-51 a 1953-54, lleihaodd nifer myfyrwyr amser-llawn y prif sefydliadau o 1,110 i 797. Gellir cynnig rhesymau—y ffaith bod cyn-filwyr gyda grant Cynllun Addysg a Hyfforddiant Bellach yn gorffen eu cyrsiau, a hefyd bod y cyfnod hwn yn gyfnod heb ddiweithdra. Y mae cyfnod felly bob amser yn denu bechgyn, wrth adael ysgol, i gymryd gwaith tâl mewn diwydiant yn hytrach na chychwyn ar gyrsiau amser-llawn mewn coleg technegol. Mae'n werth sylwi bod codiad o 4,684 (38 y cant) yn nifer y meibion rhan amser yn yr un cyfnod.

Rhwng 1954 a 1958 cafwyd cynnydd yn nifer y meibion amser llawn. Digon i gyfrif am hyn yw arfer prentisiaid crefft y Bwrdd Glo o dreulio eu blwyddyn gyntaf yn gyfan mewn coleg technegol a hefyd bod cyrsiau rhagbaratoawl amser-llawn i brentisiaid wedi eu sefydlu mewn rhai colegau technegol.

Mae nifer y merched a ddilynai gyrsiau amser-llawn bron yn dyblu o 1953 i 1958, canlyniad cynnydd yn rhif y cyrsiau a fyddai yn eu paratoi ar gyfer arholiadau mewn gwaith ysgrifenyddol, mewn arlwyo bwyd ac mewn nyrsio rhagbaratoawl. Er bod nifer y merched a ddilynai gyrsiau rhan amser wedi mwy na threblu rhwng 1946 a 1958, y mae o hyd yn isel i'w ryfeddu. Yn gyffredinol, mae llawer o ddosbarthiadau nos, yn arbennig rhai i ferched, heb ogwydd tuag at ofynion galwedigaeth a thebyg mai hyn yw'r rheswm am y lleihad yn nifer y myfyrwyr nos rhwng 1951 a 1952, a rhwng 1957-58 pryd y codwyd y tâl a ofynnid am ddilyn y cyrsiau.

Natur y Gwahanol Gyrsiau

Cyrsiau Rhyddhad Dydd

Fel y dengys y tabl, bu cynnydd triphlyg yn rhif mynychwyr dosbarthiadau dydd rhan-amser rhwng 1947 a 1958. Dyma un o nodweddion arbennig addysg dechnegol er 1945. Dengys ystadegau'r 38 prif sefydliad technegol mwyaf yng Nghymru fod 94·4 y cant o'r disgyblion yma yn 1958-59 yn ddisgyblion 'rhyddhad dydd'—h.y. disgyblion a ollyngwyd o'u gwaith, heb golli tâl, ar un diwrnod o'r wythnos i ddilyn cwrs. Y mae rhai diwydiannau, yn arbennig y diwydiant adeiladu, diwydiant peirianneg a'r diwydiant mwyngloddio, yn fwy parod nag eraill i gynnig y cyfle hwn i'w prentisiaid.

Cyrsiau Rhyngosod

Cafodd y rhain gryn lawer o gyhoeddusrwydd yn ddiweddar. Dyma natur a ffurf y crysiau Uwch sy'n arwain i'r Ddiploma Genedlaethol Uwch ac i'r Ddiploma mewn Technoleg. Nodwyd eisoes (tud. 74) ddarfod cychwyn cyrsiau o'r math yma yn Ysgol Fwyngloddio Trefforest yn 1913 ac yng Ngholeg Technegol Caerdydd yn 1919. Ond, er hyn, prin yw eu nifer yng Nghymru. Cynhelir y rhan fwyaf ohonynt yng Ngholeg Technoleg Uwch Cymru ac yng Ngholeg Technoleg Morgannwg (gweler atodiad B a C).

Cyrsiau Rhyddhad Cryno

Newydd ddyfodiad yw'r math hwn o gwrs yng Nghymru. Fel arfer bydd y cwrs wedi ei grynhoi i dri chyfnod o fis yr un y flwyddyn o astudiaeth llawn-amser. Yn ychwanegol at hyn yn ystod gweddill y flwyddyn mynychir dosbarth nos unwaith yr wythnos lle y bo modd. Pery'r cyrsiau am bedair neu bum mlynedd ac yr oeddynt ar waith yn Llandaf, Casnewydd a'r Drenewydd yn 1958-59. Y mae arwyddion o ddatblygu mawr ar y cyrsiau hyn yn y dyfodol agos.

Cyrsiau Amser-Llawn Cyn-brentisiaeth

Er 1956, y mae nifer o golegau technegol wedi cychwyn cwrs blwyddyn amser-llawn ar gyfer rhai sy'n gadael ysgolion uwchradd. Gelwir hwy yn Gyrsiau Cyn-brentisiaeth neu'n Gyrsiau Rhagbaratoawl mewn Peirianneg. Bron yn ddieithriad derbyniant fyfyrwyr o ysgolion uwchradd modern rhwng 15 a 16 oed. Yn 1958-59 yr oedd wyth cwrs felly ar gael. Mae'r maes llafur ac arholiadau pen y cwrs yn amrywio o'r naill goleg i'r llall. Nod y cwrs yw cyflwyno gwybodaeth a hyfforddiant ymarferol fel rhagarweiniad i'r diwydiant arbennig a fydd maes o law yn derbyn y disgybl yn brentis. Am hynny bydd llawer o waith technegol yn y maes llafur megis ymarfer gweithdy, lluniadu technegol, gwyddoniaeth a mathemateg. Weithiau dibynnir ar arholiadau mewnol, bryd arall anelir at arholiadau allanol megis Tystysgrif Cymdeithas Frenhinol y Celfyddydau neu lefel Gyffredinol y Dystysgrif Addysg Gyffredinol mewn ychydig bynciau. O ddilyn y cwrs yn llwyddiannus a hefyd gael prentisiaeth, mae'r ffordd yn glir i'r myfyriwr da ddilyn blwyddyn gyntaf cwrs y Dystysgrif Genedlaethol. Gall y gweddill gwanach ddilyn cwrs crefft y *City and Guilds* neu efallai gwrs rhagbaratoawl i'r Dystysgrif Genedlaethol. Gwneir darpariaeth gyffelyb ar gyfer merched mewn llawer coleg technegol. Cynhelir cyrsiau amser-llawn, sydd fel rheol yn parhau am ddwy flynedd, mewn gwaith ysgrifenyddol, arlwyo bwyd a nyrsio.

Cyrsiau Helaethach mewn Ysgolion Uwchradd

Mae rhai ysgolion uwchradd, rhai modern yn arbennig, yn awr yn dechrau datblygu cyrsiau ar gyfer disgyblion sydd heb lawer o allu academaidd ond sydd yn dewis aros ymlaen yn yr ysgol y tu hwnt i bymtheg oed, sef yr oedran a bennwyd gan ddeddf gwlad. Gogwydd dechnegol, i baratoi bechgyn ar gyfer prentisiaeth sydd i rai ohonynt; y mae eraill yn paratoi merched ar gyfer masnach, nyrsio neu arlwyo bwyd, a cheir eraill eto sy'n fwy cyffredinol eu natur. Fel arfer arweiniant i arholiad gadael ysgol a lunir gan yr awdurdod addysg lleol ond y mae lleiafrif o'r cyrsiau yn terfynu gydag arholiad lefel Gyffredinol y G.C.E. Yn sesiwn 1958-59 gwelwyd ar ôl archwilio fod tua 40 o'r 224 ysgol fodern uwchradd yng Nghymru yn cynnal cyrsiau fel hyn.

Datblygiad Cyrsiau'r Dystysgrif Genedlaethol a'r Ddiploma wedi'r Rhyfel

Ers y rhyfel cynyddodd rhif y rhai a astudiai ar gyfer arholiadau'r Dystysgrif Genedlaethol ac arholiadau'r *City and Guilds* ym mhrif sefydliadau addysg dechnegol Cymru yn ddirfawr. Ers 1954, y Cyd-bwyllgor Addysg Cymreig fu'r Cotff Arholi Rhanbarthol ar gyfer arholiadau'r Dystysgrif Genedlaethol hyd at y lefel Gyffredinol. Dyma'r nifer a enillodd y dystysgrif drwy arholiadau'r Cyd-bwyllgor o 1955 i 1959.

Blwyddyn	Adeiladu	Cemeg	Masnach	Peirianneg		Metaleg	Mwyn-gloddio
				Drydanol	Fecanyddol		
1955	17 (38)	24 (41)	6 (23)	48 (132)	86 (257)	11 (35)	96 (164)
1956	19 (46)	32 (54)	12 (29)	79 (128)	111 (286)	8 (34)	83 (154)
1957	33 (66)	32 (70)	15 (27)	82 (134)	171 (332)	6 (35)	121 (206)
1958	35 (72)	34 (61)	12 (28)	102 (186)	206 (437)	14 (37)	99 (210)
1959	71 (105)	74 (130)	25 (43)	161 (283)	374 (584)	36 (66)	178 (272)

(Dengys y ffigurau mewn cromfachau gyfanrif yr ymgeiswyr)

Bu cynnydd hefyd yn nifer y colegau sy'n paratoi myfyrwyr ar gyfer yr un arholiadau o 1955 i 1959.

Blwyddyn	Adeiladu	Cemeg	Masnach	Peirianneg		Metaleg	Mwyngloddio
				Drydanol	Fecanyddol		
1955	4	4	4	6	6	5	7
1959	8	8	6	12	12	6	8

Yn sesiwn 1958-59, yr oedd tri Choleg Technegol yng Nghymru yn paratoi myfyrwyr ar gyfer y Ddiploma Genedlaethol Uwch a deg ar gyfer y Dystysgrif Genedlaethol Uwch. Dyma nifer y rhai llwyddiannus yn y tair blynedd, 1950, 1955 a 1959. Dengys y tabl gynnydd ym mhob pwnc, o 1950 i 1955, ond dim ond mewn cemeg a pheirianneg gynhyrchol y gwelir newid o bwys rhwng 1955 a 1959.

Diploma Genedlaethol Uwch

Blwyddyn	Adeiladu	Peirianneg		Mwyngloddio
		Drydanol	Fecanyddol	
1950	7 (15)	4 (10)	17 (23)	—
1955	11 (16)	—	9 (19)	14 (18)
1959	3 (5)	5 (6)	18 (19)	18 (18)

Tystysgrif Genedlaethol Uwch

Blwyddyn	Ffiseg Gymhwysol	Adeiladu	Peirianneg					Metaleg	Mwyngloddio	Cemeg
			Gemegol	Sifil	Drydanol	Fecanyddol	Gynhyrchol			
1950	—	17 (19)	—	—	61 (77)	87 (122)	—	2 (2)	—	20 (25)
1955	—	29 (32)	10 (10)	—	108 (153)	139 (206)	11 (14)	16 (30)	33 (45)	48 (61)
1959	20 (25)	34 (41)	15 (15)	10 (11)	111 (187)	120 (175)	40 (50)	14 (26)	42 (60)	62 (79)

(Dengys y ffigurau mewn cromfachau gyfanrif yr ymgeiswyr.)

Ystadegau ynglŷn â Chyrsiau Adeiladu, Peirianneg a Mwyngloddio

Cyrsiau mewn adeiladu, peirianneg (drydanol a mecanyddol), a mwyngloddio yw asgwrn cefn gwaith y mwyafrif o'r colegau technegol yng Nghymru. A dyma eu maint yn sesiwn 1957-58, yn ôl nifer y myfyrwyr.

Adeiladu

Cwrs	Nifer y Colegau	Nifer y Myf.
Diploma Genedlaethol Uwch	1	25
Tystysgrif Genedlaethol Uwch	5	101
Tystysgrif Genedlaethol Gyffredinol (S.1, S.2 a S.3)	12	508
Cyrsiau'r *City and Guilds*:		
Gwaith bric	18	763
Gwaith Plastrwyr ...	9	210
Gwaith Plymwyr ...	16	546
Gosod Offer Nwy ...	9	230
Gwaith Saer ac Asiedydd	21	1,446
Gwaith coed peiriannol	4	147
Gwaith paentwyr ac addurnwyr tai ...	7	249

Mwyngloddio

Cwrs	Nifer y Colegau	Nifer y Myf.
Diploma Genedlaethol ...	1	44
Tystysgrif Genedlaethol Uwch	3	81
Tystysgrif Genedlaethol Gyffredinol (S.1, S.2 a S.3)	7	795
(S.1)	9	276
Tystysgrif Mecanwyr a Thrydanwyr Pyllau Glo:		
Blwyddyn gyntaf (amser-llawn)	9	361
Blynyddoedd dilynol (Mecanyddol) ...	8	182
Blynyddoedd dilynol (Trydanol)	6	178
Tystysgrif Mwyngloddio glo	5	129
Cwrs Dirprwy Reolwyr Tebygol	10	413
Cwrs Mwyngloddio i ddysgwyr (8 wythnos amser-llawn)	10	2,211

Peirianneg Fecanyddol

Diploma Dechnoleg ...	1	42
Diploma Genedlaethol Uwch	3	92
Tystysgrif Genedlaethol Uwch	9	523
Tystysgrif Genedlaethol Uwch (Cynhyrchu ...	5	141
Tystysgrif Genedlaethol Gyffredinol (S.2 a S.3)	15	1,747
(S.1, Mec. a Thryd) ...	31	1,711
Cyrsiau'r *City and Guilds*:		
Arfer Crefft Peirianneg Fecanyddol a Pheirianneg Gweithdy Peiriant	25	1,978
Weldio	10	413
Gwaith Llenfetel ...	4	100
Tystysgrif Crefftwyr Moduron (y flwyddyn gyntaf, yr ail a'r 3edd)	13	1,023
(y flwyddyn gyntaf yn unig)	3	52

Peirianneg Drydanol

Diploma Genedlaethol Uwch	2	39
Tystysgrif Genedlaethol Uwch	7	383
Tystysgrif Genedlaethol Gyffredinol (S.2 a S.3)	14	845
Cyrsiau'r *City and Guilds*:		
Gosod Offer Trydan ...	17	893
Cwrs Technegwyr Trydan	4	113

Ysgoloriaethau Technegol y Wladwriaeth

Gellir dal yr ysgoloriaethau hyn mewn prifysgolion neu mewn sefydliadau addysg bellach. Cynigir hwy bob blwyddyn i fyfyrwyr sydd wedi mynychu sefydliadau addysg bellach ac wedi dilyn yn llwyddiannus gwrs y Ddiploma Genedlaethol Gyffredinol, neu'r Dystysgrif Gyffredinol neu ryw gwrs tebyg o ran ei safon trwy astudiaeth ran-amser. Bydd ysgolor yn dilyn cwrs sy'n foddhaol i'r Gweinidog Addysg ac a fydd fel arfer yn arwain i radd Anrhydedd neu i'r

Ddiploma Dechnoleg. Ond weithiau, cymeradwyir cwrs sy'n arwain at gymwysterau eraill o safon deilwng.

Yn y pum mlynedd o 1955 i 1959, cynigiwyd 8, 12, 14, 15 ac 18 ysgoloriaeth yn y drefn hon, i fyfyrwyr o sefydliadau addysg bellach yng Nghymru. Yn sesiwn 1958-59 yr oedd 51 ysgolor ym Mhrifysgol Cymru a phump yn ychwanegol mewn sefydliadau eraill yng Nghymru.

Graddio'r Colegau Technegol

Yn Nghylchlythyr 305, a ddosbarthwyd ar hirddydd haf 1956, rhoddwyd braslun o fwriadau diweddaraf y Weinyddiaeth ar drefnu addysg dechnegol. Bwriadwyd graddio'r colegau technegol yn ôl safon eu gwaith i bedair gradd —Colegau Lleol, Colegau Cylch, Colegau Bro a Choleg au Technoleg Uwch.

Pwrpas *Colegau Lleol* yw ateb gofynion lleol ac at ddibenion galwedigaeth, cynhelir ynddynt gyrsiau, rhai rhan-amser gan mwyaf, sy'n arwain i'r Dystysgrif Genedlaethol Gyffredinol, i arholiadau canolradd y *City and Guilds* a'r rhai Terfynol weithiau, a hefyd i arholiadau canolradd cyrff proffesiynol. Mewn llawer coleg lleol mae trefnu cyrsiau amser-llawn i'r rhai sydd wedi troi eu pymtheg oed ar droed yn awr, cyrsiau cyn-brentisiaeth i fechgyn a chyrsiau rhagbaratoawl mewn nyrsio ac arlwyo bwyd i ferched. Gelwir y rhan fwyaf o'r colegau hyn yn Golegau Addysg Bellach.

Yn ychwanegol at sicrhau peth trefniant tebyg i eiddo'r colegau lleol, rhaid i'r *Colegau Cylch* ateb gofynion eu cylchoedd am gyrsiau uwch megis rhai'r Tystysgrif Genedlaethol Uwch ac arholiadau terfynol y *City and Guilds*. Os bydd digon o ofyn, mae rhai'n cynnal cyrsiau rhyngosod ar gyfer y Ddiploma Genedlaethol Uwch.

Y mae *Colegau Bro*, yn ôl yr enw, yn ateb gofynion cylchoedd ehangach. Cyrsiau uwch yw eu prif faes, ar gyfer Diploma Genedlaethol Uwch a Thystysgrif Genedlaethol Uwch, a gwaith o gyffelyb safon, cyrsiau gweddus i dechnegwyr a thechnolegwyr o safon uchel. Ar hyn o bryd un Coleg Bro sydd yng Nghymru sef Coleg Technoleg Morgannwg yn Nhrefforest.

Y *Colegau Technoleg Uwch* yw pinacl y pyramid. Cyrsiau uwchradd yn unig yw eu maes; ni dderbyniant neb heb feddu ohonynt gymhwyster megis y Dystysgrif Genedlaethol Gyffredinol neu lefel Uwch y Dystysgrif Addysg Gyffredinol. Fel arfer cyrsiau amser-llawn neu gyrsiau rhyngosod ar gyfer technolegwyr ydynt. Ynddynt, fel rheol, y paratoir ar gyfer y Ddiploma mewn Technoleg sydd o safon debyg i eiddo gradd anrhydedd prifysgol ym Mhrydain. Cyflwynir y Ddiploma Dechnoleg gan y Cyngor Cenedlaethol ar Ddyfarniadau Technolegol a sefydlwyd gan y Gweinidog Addysg yn 1955. Gan y bwriedir iddynt weithredu ar lefel gradd prifysgol ac ar lefel uwch, rhaid i'r colegau ateb gofynion arbennig o ran hwylustod eu hadeiladau, eu staff a'u cyrff llywodraethol. Un coleg o'r fath sydd yng Nghymru, sef Coleg Technoleg Uwch Cymru yng Nghaerdydd.

Pwrpas y Weinyddiaeth wrth lunio'r drefn hon oedd darparu fframwaith, ar sail oedd eisoes yn bod, y gellid ei addasu a'i ehangu i ateb gofynion y dyfodol. Gellir codi safon coleg, os bydd amgylchiadau'n cyfiawnhau hynny a gobeithid y byddai yn symbyliad i golegau ehangu a chodi safon eu gwaith. Y mae llwyddiant y gyfundrefn hon yn dibynnu ar gydgysylltu'r gwaith dros rhanbarth eang. Am hynny y pwysleisiodd y Cylchlythyr mor drwm angen cyd-ddealltwriaeth a chydweithrediad rhwng awdurdodau lleol.

Coleg Technoleg Uwch Cymru

Pennwyd Coleg Technoleg a Masnach Caerdydd yn Goleg Technoleg Uwch ym Mis Mawrth 1957 ac ail-enwyd ef yn Goleg Technoleg Uwch Cymru. Er yr adeg honno, trosglwyddwyd cyrsiau y barnwyd bod eu safon yn rhy isel i Goleg o'r radd yma i Goleg Technegol Llandaf ac i Goleg Celfyddyd Caerdydd. Codwyd yr Adran Bobi ac Arlwyo Bwyd ar ei thraed ei hun fel sefydliad newydd y tu allan i'r coleg. Dyma nifer y myfyrwyr yng ngwahanol adrannau Coleg Technoleg Uwch Cymru yn sesiwn 1958-59.

Adran	Amser-llawn	Rhyngosod	Rhan-amser dydd a nos
Pensaernïaeth	134	—	16
Adeiladu	5	25	184
Cemeg	4	3	191
Masnach	130	—	1,563
Peirianneg Drydanol	—	22	134
Saesneg	30	—	451
Mathemateg	—	—	234
Peirianneg Fecanyddol	71	66	122
Morwriaeth	177	—	6
Fferylliaeth	102	—	—
Ffiseg	50	—	30
Cyfanrif	703	116	2,931

Yn awr, dyma ystadegau blwyddyn olaf y Coleg fel Coleg Technoleg a Masnach yn 1956-57:

Amser-llawn	*Rhan-amser*	*Cyfanrif*
1,265	5,282	6,547

Y mae cneifio'r gwaith elfennol i ffwrdd felly wedi gostwng nifer y myfyrwyr amser-llawn 35 y cant a'r rhai rhan-amser 45 y cant rhwng 1957 a 1959.

Rhoddodd y Pwyllgor Cenedlaethol ar Ddyfarniadau Technolegol awdurdod i'r Coleg gynnal cyrsiau rhyngosod ar gyfer y Ddiploma Dechnoleg mewn peirianneg fecanyddol ym mis Medi 1956, mewn peirianneg drydanol (ym mis Medi 1958) ac mewn ffiseg gymhwysol ym mis Medi 1958. Mae dau gwrs arall, sef peirianneg cynhyrchol ac ystadegaeth, yn cael ystyriaeth ar hyn o bryd. Yn 1958-59, gynhaliwyd cyrsiau Diploma Genedlaethol Uwch mewn adeiladu, peirianneg drydanol, a pheirianneg fecanyddol. Y mae eisoes hawl i gychwyn Cwrs Diploma debyg mewn cemeg yn 1959-60.

Llanw'r Cyrsiau Rhyngosod Uwch

Llenwir y cyrsiau hyn yng Ngholeg Technoleg Uwch Cymru ac yng Ngholeg Technoleg Morgannwg gan mwyaf gan ddisgyblion ysgolion gramadeg a fu'n llwyddiannus mewn pynciau pwrpasol yn arholiadau lefel Uwch y Dystysgrif Addysg Gyffredinol. Y mae rhai ohonynt eisoes mewn diwydiant a gollyngir hwy i fynd i'r coleg am chwe mis bob blwyddyn (seiliad gwaith); daw eraill yn syth i'r coleg o'r ysgol ac ânt allan o'r coleg am gyfnodau o ymarfer diwydiannol (seiliad coleg). Fel arfer telir ei gyflog i fyfyriwr seiliad gwaith pan fo yn y coleg, ond beth bynnag am hyn, gall myfyriwr anghenus, boed fyfyriwr seiliad gwaith neu seiliad coleg, ofyn am gymorth dros ei amser yn y coleg oddi wrth awdurdod addysg lleol. (Gweler Memorandwm Gweinyddol 567 y Weinyddiaeth Addysg, yr 22ain o Ebrill, 1958). Y mae 71 o fyfyrwyr wedi eu gollwng o'u gwaith heb golli cyflog yng Ngholeg Technoleg Uwch Cymru yn awr; daw 27 ohonynt o ddiwydiannau a genedlaetholwyd, a 44 o ddiwydiannau preifat. Yng Ngholeg Technoleg Morgannwg daw 88 tebyg o ddiwydiannau a genedlaetholwyd a 22 o rai preifat.

Tra siomedig, hyd yn hyn, fu nifer y myfyrwyr a chanddynt Dystysgrif Genedlaethol Gyffredinol a gychwynnodd ar gyrsiau'r Ddiploma Dechnoleg. Yn arholiadau'r Dystysgrif Genedlaethol Gyffredinol yn 1958, enillodd 33 o fyfyrwyr colegau technegol Cymru y cymhwyster angenrheidiol i ddilyn cwrs y Ddiploma Dechnoleg mewn peirianneg drydanol ond dengys atodiad A nad ymunodd un dyn byw ohonynt â'r cwrs pwrpasol ym mis Medi 1958 yng Ngholeg Technoleg Uwch Cymru. Yr un modd mewn peirianneg fecanyddol, o'r 69 posibl dim ond tri a ymunodd. Nid ymunodd neb a chanddo na chymhwyster Tystysgrif Genedlaethol Gyffredinol na llwyddiant ar lefel Uwch y Dystysgrif Addysg Gyffredinol â chwrs y Ddiploma Dechnoleg mewn ffiseg gymhwysol ym mis Medi 1958 yng Ngholeg Technoleg Uwch Cymru.

Siomedig yn yr un modd yw'r nifer sy'n dilyn cyrsiau'r Ddiploma Genedlaethol Uwch mewn peirianneg fecanyddol a thrydanol yng Nghymru. Enillodd 97 y cymhwyster i wneud hyn mewn peirianneg drydanol yn arholiadau'r Dystysgrif Genedlaethol Gyffredinol yn 1958, ond dim ond un ohonynt a ymunodd â'r cwrs ym mis Medi 1958. Felly hefyd mewn peirianneg fecanyddol—tri yn unig o blith 146 a ymunodd.

Y Cynnydd yn Narpariaeth y Prifysgolion

I ateb y gofyn cynyddol am wyddonwyr a thechnolegwyr cymerwyd camau breision yn ystod y blynyddoedd olaf hyn i ddarparu hyfforddiant i rai y bernid eu bod yn addas ac yn alluog i ennill cymwysterau o radd uchel ac arbenigol ym maes gwyddoniaeth a thechnoleg. Awgrymwyd yn Adroddiad Pwyllgor Cyflenwad Gwyddonwyr, y Cyngor Ymgynghorol ar Bolisi Gwyddonol yn 1956 'y byddai'n rhaid wrth gynnydd yn rhif y rhai a enillai gymhwyster bob blwyddyn mewn gwyddoniaeth a pheirianneg, o dua 10,000 yn 1954-55 i dua 20,000 yn 1970 . . . . os yw'r tyfiant yn economi'r wlad a fernir yn angenrheidiol i ddatblygu'n ddigon buan.' Y 'cymhwyster' y meddyliai'r Pwyllgor amdano yn ei Adroddiad oedd gradd Prifysgol mewn gwyddoniaeth neu beirianneg neu rywbeth cyfwerth â hynny.

Mi dyfodd y prifysgolion gryn dipyn ar ôl y rhyfel. Argymhellodd Pwyllgor Barlow a benodwyd yn 1945, wrth ystyried problem cyflenwad o weithwyr ym maes gwyddoniaeth, y dylid dyblu nifer y sawl a fyddai'n graddio mewn gwyddoniaeth y cyfle cyntaf posibl. Pedair blynedd yn unig a gymerodd hi i'r prifysgolion sicrhau hyn. Yn ei adroddiad yn 1952, serch hynny, dywedodd Pwyllgor Cyflenwad Gwyddonwyr fod prinder gwyddonwyr a pheirianwyr hyfforddedig o bob math bron yn debyg o barhau er gwaethaf y cynnydd ers y rhyfel. Yna paratowyd cynlluniau i gryfhau adrannau peirianneg a gwyddoniaeth amryw o brifysgolion, ac y mae'r cynnydd yn y cyfeiriad hwn yn mynd rhagddo ar hyn o bryd.

Prifysgol Cymru

Yn ystod ein hymchwiliad cawsom wybod am raglen ddatblygu uchelgeisiol Cyfadrannau Gwyddoniaeth Bur a Chymhwysol Prifysgol Cymru a chyfarfuasom ag amryw o benaethiaid adran. Nid hwn yw'r lle priodol i adolygu neu i bwyso a mesur yr hyn a wneir yn awr ac felly fe'n cyfyngwn ein hunain i sylw byr ar y sefyllfa. Digwyddodd datblygiadau trawiadol. Gorffennwyd adeiladau newydd, mae eraill ar waith a chynllunir ar gyfer ychwanegiadau yn y dyfodol. Bydd yr adeiladau hyn yn sicrhau cynnydd sylweddol yng ngallu'r Brifysgol i gynnig hyfforddiant mewn gwyddoniaeth a thechnoleg ar gyfer gradd ac ar gyfer gwaith ar ôl graddio.

Cododd rhif myfyrwyr y gwahanol adrannau gryn dipyn er bod nifer y myfyrwyr disglair yn tueddu i aros yr un. Mae hyn i'w ddisgwyl gan y byddai'r rhain hyd yn oed cyn y rhyfel wedi ennill ysgoloriaeth o ryw fath neu'i gilydd i ddod i'r Brifysgol. Cytunai y rhan fwyaf o benaethiaid adran fod lle yn y Brifysgol i'r myfyriwr cymedrol ei allu, y myfyriwr a allai ennill gradd gyffredin dda. Credai rhai y medrai mwy o ddisgyblion y chweched dosbarth nag a ddeuai i'r Brifysgol yn awr, elwa ar gwrs fel hynny. Ar y llaw arall, credai eraill mai o'r braidd yr oedd rhif y rhai a geisiodd gael eu derbyn ar gyfer cwrs gradd (rhai a chanddynt gymwysterau boddhaol yn hytrach na'r lleiafswm a oedd yn angenrheidiol) yn uwch na rhif y lleoedd a oedd ar gael ar eu cyfer. Mynegodd rhai adrannau eu bod yn fodlon ar ansawdd y myfyrwyr yn eu dosbarthiadau anrhydedd ond cytunent na ellid disgwyl cynnydd mawr yn rhifedi'r categori arbennig hwn a bod tuedd i fyfyrwyr disglair ddal i fynd i'r hen brifysgolion.

Ceir cydweithrediad agos rhwng yr ysgolion a'r Brifysgol sy'n fanteisiol i'r naill a'r llall, yn arbennig i'r plant ysgol ac y mae'n dda gan y Cyngor nodi y cynhelir nifer o gynadleddau i hyrwyddo'r cydweithrediad hwn.

Mae cynnydd yn rhif y myfyrwyr o allu cymedrol a ddaw i'r Brifysgol yn tueddu i beri bod rhif y rhai sy'n methu yn arholiadau'r Brifysgol yn uwch na'r hyn oedd yn y cyfnod cyn y rhyfel. Yr oedd penaethiaid adrannau yn poeni ynglŷn â'r agwedd hon ar dyfiant y Brifysgol ac y maent yn gwylio'r sefyllfa'n ofalus. Fe gytunid yn gyffredinol y byddai'n werth lleihau maes llafur y Dystysgrif Addysg ar y lefel Uwch mewn amryw o'r gwyddorau er mwyn rhoi hêr i allu meddyliol disgybl yn y chweched dosbarth yn hytrach na llwytho ei gof.

Dylid nodi y gall myfyrwyr sy'n graddio mewn gwyddoniaeth bur, os mynnant hynny, gael eu trosglwyddo i adrannau gwyddoniaeth gymhwysol i gael rhagor o hyfforddiant ac i gychwyn ar waith ymchwil. Mae hon yn ffordd i ddechrau ar yrfa gwyddonydd diwydiannol a all yn hawdd ddod yn fwy cyffredin yn y dyfodol. Fe ofelir am gyswllt personol rhwng gwahanol adrannau a diwydiant a rhoddir pob cyfle i'r myfyrwyr ennill profiad pwrpasol mewn diwydiant yn ystod eu gyrfa yn y Brifysgol. I lawer y mae profiad felly yn rhan anhepgorol o'u cwrs.

At y prifysgolion y bydd yr ysgolion a'r colegau technegol yn naturiol yn edrych am gyflenwad di-baid o athrawon a chanddynt gymwysterau boddhaol. Mae'r prinder athrawon mathemateg a gwyddoniaeth eisoes yn effeithio ar ansawdd y myfyrwyr a ddaw i'r prifysgolion ac ar ansawdd y gwyddonwyr a dderbynnir i ddiwydiant. Ni ellir gorbwysleisio difrifoldeb y sefyllfa a dylid delio â'r broblem yn ddi-drugaredd a chyda chryn ddychymyg os am gadw'r safonau rhag gostwng ymhellach fyth.

Ystadegau ynglŷn â Chyrsiau Colegau Prifysgol Cymru mewn Gwyddoniaeth a Gwyddoniaeth Gymhwysol

Rhestrir ffigurau parthed nifer myfyrwyr amser-llawn colegau Prifysgol Cymru o 1937-38 i 1957-58 yn atodiad D. Bu cwymp ar ddechrau'r cyfnod; cyrhaeddwyd isafbwynt adeg y rhyfel ac yna dringwyd i uchafbwynt yn 1948-50 drwy ddychweliad cyn-filwyr. Yna bu cwymp hyd 1953-55 a chodiad cyson wedyn hyd 1958. Dyma'r patrwm a ddaw i'r golwg o gyfrif myfyrwyr a oedd yn darllen ar gyfer gradd ym mhynciau gwyddoniaeth a'r celfyddydau. Mewn cyrsiau gwyddoniaeth gymhwysol cododd y nifer o 1937 i 1942, yna cwympodd ychydig cyn codi i uchafbwynt yn 1948-49 gan gwympo eilwaith hyd 1953-54 ac yna godi'n sylweddol.

O gymharu ffigurau sesiwn 1957-58 â sesiwn 1937-38, canfyddir y cynnydd a ganlyn:

Cyrsiau'r celfyddydau—49 y cant; Cyrsiau gwyddoniaeth—163 y cant; Cyrsiau gwyddoniaeth gymhwysol—316 y cant.

Dyma ddosbarthiad o ffigurau y flwyddyn 1957-58:

Prifysgol	Cyfartaledd o'r holl fyfyrwyr yn darllen y celfyddydau (cyn graddio ac ar ôl hynny)	Cyfartaledd o'r holl fyfyrwyr yn darllen gwyddoniaeth (cyn graddio ac ar ôl hynny)	Cyfartaledd o'r holl fyfyrwyr yn darllen gwyddoniaeth gymhwysol (cyn graddio ac ar ôl hynny)
Prifysgol Cymru	37 y cant	30 y cant	12 y cant
Holl Brifysgolion Prydain ynghyd	42 y cant	22 y cant	14·7 y cant

Dangosir y cynnydd yn nifer graddedigion Prifysgol Cymru mewn gwyddoniaeth a gwyddoniaeth gymhwysol rhwng 1938 a 1958 yn y tabl canlynol:

Blwyddyn	Nifer y graddau cyntaf mewn gwyddoniaeth a gwyddoniaeth gymhwysol	Nifer y graddau anrhydedd mewn gwyddoniaeth	Nifer y graddau anrhydedd mewn gwyddoniaeth gymhwysol
1937-38 ...	230	125	10
1947-48 ...	462	160	76
1957-58 ...	493	203	64

Prifysgol Cymru yw un o'r ychydig iawn o brifysgolion sy'n barod i dderbyn cymwysterau'r Dystysgrif Genedlaethol yn lle'r matric arferol. Felly mae'r Brifysgol yn derbyn ceisiadau am dderbyniad, yn enwedig i adrannau peirianneg, o bob rhan o Brydain. Dywed yr adrannau hyn fod y goreuon o'r myfyrwyr a dderbynnir fel hyn gystal yn eu gwaith â'r rhai a ddaw yn union o ysgolion gramadeg. O'r deuddeg gradd anrhydedd dosbarth cyntaf a gyflwynwyd yn ddiweddar gan adrannau peirianneg un o'r colegau, aeth pump i fyfyrwyr a ddaeth o golegau technegol gyda'r Dystysgrif Gyffredinol. Mewn coleg arall, enillwyd tair allan o bump gradd yn y dosbarth cyntaf gan y math yma o fyfyriwr. Y mae'n dda gan y Cyngor nodi llwyddiant y myfyrwyr hyn a gobeithia y bydd i Ddiwydiant a'r Brifysgol ddal ati i gefnogi'r drefn hon.

Gwragedd a Merched yn Dilyn Cyrsiau Colegau Technegol

Cododd nifer y rhain hefyd yn sylweddol rhwng 1948 a 1958 ym mhrif sefydliadan technegol Cymru. Dengys y tabl ar dudalen 77, i'r rhai amser llawn gynyddu o 592 i 1,853, y rhai rhan-amser o 1,011 i 2,630 a rhai dosbarthiadau nos o 9,625 i 10,271. O'r 4,483 a ddilynai gyrsiau dydd yn ystod blwyddyn golegol 1957-58, yn fyfyrwyr amser-llawn a rhan-amser, yr oedd 3,196, sef 1,681 amser-llawn a 1,515 rhan-amser, yn dilyn cyrsiau a weddai yn bendant i alwedigaethau arbennig. O blith y cyrsiau amser-llawn, y ddau grwp mawr oedd cyrsiau masnach (1,175 myfyriwr, 70 y cant) a chyrsiau meddygol cynorthwyol (257 myfyriwr, 15 y cant). O'r cyrsiau rhan-amser (1,515 myfyriwr), yr oedd masnach yn rhoi cyfrif am 565 (37 y cant), pynciau tŷ am 446 (31 y cant), a chemeg am 126 (8 y cant). Yn ôl pob arwydd, bydd cynnydd eto yn nifer y merched a fydd yn dilyn cyrsiau amser-llawn fel y datblygir cyrsiau newydd rhagbaratoawl mewn nyrsio ac arlwyaeth ac fel yr â'r gofyn cynyddol am ychwaneg o hyfforddiant mewn pynciau masnach ar gynnydd.

Dyma ddosraniad o rif y merched a ddilynai gyrsiau'r Dystysgrif Genedlaethol a chyrsiau tebyg mewn technoleg ym mhrif sefydliadau technegol Cymru yn sesiwn 1957-58. Dosrennir hefyd yn ôl galwedigaeth rhai ohonynt.

Cwrs	Nifer y Merched	Galwedigaeth	Nifer
B.Sc. (Cyffredinol)	2	Technegwyr labordy	181
O.N.C. (Cemeg)	85	Radiograffwr	19
H.N.C. Cemeg	5	Lluniadures	17
O.N.C. Ffiseg Gymhwysol ...	7	Trêswr	16
A.R.I.C.	14	Cynorthwywr Swyddfa Lluniadu	4
O.N.C. Peirianneg Fecanyddol...	40	Technegwr (Peirianneg Drydanol)	3
H.N.C. Peirianneg Fecanyddol...	1	Peiriannydd Cynorthwyol (Trydan)	2
O.N.C. Peirianneg Drydanol ...	3	Prentis (Peirianneg Drydanol) ...	2
O.N.C. Metaleg	4	Mesurwr Maint Iau	2
O.N.C. Adeiladu	5	Swyddog Gwyddonol (Bwrdd Glo)	2
O.N.C. Defnydd wedi ei wau ...	9	Prentis (Peirianneg Radio) ...	1
Technegwyr labordai meddygol	52	Cyfrifiannwr	1
Llindrêswr	5		
Technegwyr Labordai	8		
Trwsio Teledu	1		
Technoleg Plastig	1		
Radiograffeg	19		
Fferylliaeth	1		
Diploma Peirianneg Drydanol ...	1		
Cyfanrif	263	Cyfanrif	250

Addysg Mewn Pynciau Masnach

Mae mwyafrif y colegau technegol yn cynnig hyfforddiant mewn pynciau masnach megis llaw-fer, teipio a gwaith cyffredinol ysgrifennydd. Gwneir y rhan fwyaf o'r gwaith hwn mewn dosbarthiadau nos ond y mae cynnydd o hyd yn nifer y dosbarthiadau amser-llawn i rai rhwng 15 a 17 oed sydd wedi gadael ysgol ond heb gael gwaith. Ychydig iawn o ryddhad i fynychu dosbarthiadau dydd a gafwyd yn gyffredin yn y maes hwn hyd yn hyn.

Dim ond mewn rhai colegau technegol y cynhelir cyrsiau uwch megis y rhai sy'n arwain i Dystysgrifau Cenedlaethol mewn Pynciau Masnach, Diploma mewn Astudiaethau Rheolaeth Gwaith ac arholiadau sefydliadau proffesiynol megis y *Chartered Institute of Secretaries*, yr *Institute of Bankers*, a'r *Association of Certified and Chartered Accountants*. Mewn dosbarthiadau nos y gwneir y rhan fwyaf o'r gwaith hwn befyd (er yr amlygwyd tuedd bendant i ganiatáu rhyddhad dydd ar gyfer mynychu'r cyrsiau hyn yn ystod y tair neu bedair blynedd diwethaf). Y mae adroddiad y Cyngor Ymgyngborol ar Addysg Bellach mewn Masnach (Chwefror 1959) yn annog cynnig rhyddhad dydd yn fwy cyffredinol ac yn awgrymu y dylai rhif presennol y rhai sy'n dilyn dosbarthiadau'r lefel ganolradd mewn dosbarthiadau dydd (tua 20,000) godi i 50,000 erbyn 1964 y fan bellaf. Yr ydym yn cyd-fynd yn fras â hyn.

Ysgolion Technegol Iau ac Uwchradd

Er i'r ysgolion a sefydlwyd trwy Ddeddf Addysg Ganolraddol 1889, gynnwys y gair 'technegol' yn eu henw, ar dir ymarferol ni chafodd yr agwedd hon o'u gwaith fawr o sylw. Yn 1916 yr agorwyd yr ysgol dechnegol iau gyntaf yng Nghymru yng Nghasnewydd o fewn muriau Coleg Technegol Casnewydd. Y flwyddyn ddilynol cydnabuwyd ysgol o'r fath gan y Bwrdd Addysg yng Ngholeg Technegol Caerdydd; yr oedd wedi ei sefydlu rai blynyddoedd cyn hyn. Yr oedd ynddynt ogwydd dechnegol tuag at beirianneg, adeiladu a chrefftau tebyg. Agorwyd ysgol forwriaeth dechnegol iau yng Nghasnewydd yn 1918, ac yn 1921 agorwyd ysgol debyg i 22 o fechgyn yng Ngboleg Technegol Caerdydd, drwy haelioni Syr William Reardon Smith ac eraill. Yr oedd 200 o fechgyn yn y pedair ysgol yn 1922-23 fel y canlyn:

Ysgol Dechnegol Iau Caerdydd...	44
Ysgol Forwriaeth Iau Smith	53
Ysgol Dechnegol Iau Casnewydd	64
Ysgol Forwriaeth Iau Dechnegol Casnewydd ...	39

Agorwyd ysgol dechnegol iau yn y Pentre, Rhondda, yn 1924 gyda 90 o fechgyn. Yn ystod y flwyddyn, caewyd Ysgol Forwriaeth Dechnegol Casnewydd. Arddelwyd dwy ysgol dechnegol iau arall gan y Bwrdd Addysg yn 1926, sef dwy ysgol fasnach, un yng Ngholeg Technegol Caerdydd a'r llall yng Ngholeg Technegol Casnewydd. Yn y chwe ysgol a oedd ar gael yn 1927-28 yr oedd 659 o ddisgyblion.

Agorwyd 14 yn rhagor ohonynt rhwng 1929 a 1937, y rhan fwyaf ohonynt yn y sefydliadau mwyngloddio a thechnegol a godid gan y pwyllgorau addysg lleol gyda chymorth Cronfa Les y Glowyr. (Gweler atodiad E.) Yng Nghaerdydd rhoddwyd pen ar yr ysgolion technegol iau (peirianneg a masnach) yn y Coleg Technegol yn 1931 a disgyblion y rhain oedd cnewyllyn Ysgolion Canolradd newydd Cathays. Trefnwyd meysydd llafur i ateb eu gofynion arbennig hwy. Yn 1937-38 yr oedd 1,521 yn y deunaw ysgol dechnegol iau yng Nghymru.

Rhoddwyd iddynt enw newydd—Ysgolion Technegol Uwchradd—ar ôl Deddf Addysg 1944. Aeth eu nifer ar gynnydd, ac yn 1947, yr oedd 24 ohonynt yng Nghymru, 19 i fechgyn (gyda 2,295 disgybl), 1 i ferched (gyda 99 disgybl) a 4 i fechgyn a merched gyda'i gilydd (679 o fechgyn a 277 o ferched). Yr oedd ynddynt, felly, 3,350 o ddisgyblion. Er 1947 agorwyd dwy yn ychwaneg ond caewyd wyth. Ymddengys yn awr y daw rhwng chwech a deg arall i ben eu rhawd yn y pum mlynedd nesaf. Ym mhob achos ymron, y rheswm am hyn yw newid polisi ysgolion gramadeg ac ysgolion modern yr ardal. Byddant yn derbyn dwy ffrwd o ddisgyblion a thrwy hynny'n cofleidio gwaith ysgolion technegol ac yn newid i fod yn ysgolion gramadeg-technegol neu yn ysgolion modern-technegol.

I bob un ond pedair o'r ysgolion uwchradd technegol sydd ar gael yn awr, derbynnir plant yn dair-ar-ddeg oed ar sail arholiad ysgrifenedig. Yng Nghaerdydd, y Drenewydd ac yn Abertawe, derbynnir plant yn un-ar-ddeg oed ar sail arholiad '11+.' Mae llawer yn gadael yn bymtheg oed ond bydd rhai sydd am baratoi ar gyfer arholiadau yn aros ymlaen nes eu bod yn un-ar-bymtheg neu fwy. Cynhelir arholiadau y Dystysgrif Dechnegol Uwchradd mewn peirianneg, adeiladu a masnach. Arholiadau mewnol ydynt, gyda chymedrolwyr allanol a sicrheir gan y dystysgrif, rhyddhad, mewn rhai amgylchiadau, o arholiad S.1 y Dystysgrif Genedlaethol yn y pwnc.

Dyma ystadegau perthnasol i'r arholiad bwn yn 1958:

Tystysgrif	Nifer yn cynnig	Nifer llwyddiannus	Cyfartaledd llwyddiant
Peirianneg	305	169	55·0
Adeiladu...	16	12	75·0
Masnach...	6	2	33·3
Gwyddoniaeth	32	21	65·6

Y mae rhai o'r ysgolion technegol uwchradd byn yn paratoi'r disgyblion sy'n fwy galluog na'r cyffredin ar gyfer Arholiad lefel Gyffredinol y *G.C.E.* ac y mae pedair ohonynt yn paratoi ar gyfer y lefel Uwch befyd. Yn ddiweddar, enillodd un o'r disgyblion Ysgoloriaeth y Wladwriaetb. Y mae llawer disgybl a fu'n llwyddiannus yn arholiadau lefel Gyffredinol y *G.C.E.* wedi eu symud i ysgolion gramadeg er mwyn paratoi ar gyfer arholiadau'r lefel Uwcb.

Diau y bydd y duedd bresennol i ddatblygu ysgolion gramadeg technegol dwy-ochrog yn peri i blant yn y ffrwd dechnegol gael eu paratoi ar gyfer arholiad lefel Gyffredinol y *G.C.E.* Os mai felly y bydd, fe fydd llai o ofyn am y Dystysgrif Dechnegol Uwchradd. Yr un pryd, bydd nifer o feysydd llafur newydd yn arholiad Gyffredinol y *G.C.E.* a fydd yn rhoi mwy o le i wedd ymarferol amryw o bynciau.

PENNOD II

Y Cefndir Diwydiannol

Datblygiadau Cynnar Diwydiant Haearn, Platiau Alcam a Glo

Ychydig weithio diwydiannol ar raddfa eang a welwyd yng Nghymru cyn canol y ddeunawfed ganrif. Tynnodd y galw am baearn yn ail hanner y ganrif haearnwyr o Saeson i flaenau cymoedd y de ddwyrain lle y ceid carreg haearn, carreg galch, coed a dŵr yn cydorwedd gyda digonedd o lo. O'r ardal hon, lledaenodd gwaith cynhyrchu haearn i froydd eraill yn Ne Cymru ac yn gynnar yn y bedwaredd ganrif ar bymtheg yr oedd De Cymru gyda'r canolfannau cynhyrchu haearn mwyaf yn y byd.

Tua chanol y ganrif, dechreuodd dur gymryd lle haearn gyr a haearn bwrw a chan nad oedd yn bosibl newid dulliau'r hen weithiau haearn, bu raid eu cau. Felly bu llai o gyfle i gael gwaith yn y diwydiant haearn, ond daeth cyfle newydd yn y glofeydd a oedd yn tyfu'n gyflym. Yn 1720, dyfeisiodd Hanbury ffyrdd newydd o rolio platiau haearn a daeth ardal Pont-y-pŵl yn ganolfan gwneud platiau alcam ac erbyn dechrau'r bedwaredd ganrif ar bymtheg yr oedd y diwydiant hwn wedi ei sefydlu yn llawer mwy eang, yng Nghaerdydd, Casnewydd, y Forest of Dean ac yn rhan orllewinol De Cymru.

Bu newid hefyd yn y diwydiant glo, yn arbennig ddefnyddio golosg glo yn lle coed i doddi haearn. Tynnodd y diwydiannau glo, dur a phlatiau alcam lawer o weithwyr o ardaloedd amaethyddol cyfagos yng Nghymru a De Orllewin Lloegr, ac, erbyn dau-ddegau'r ganrif bresennol, yr oedd yn Ne Cymru boblogaeth ddiwydiannol fawr yn dibynnu am eu bara ar waith cynhyrchu a chario glo, dur a phlatiau alcam.

Y Dirwasgiad Diwydiannol

Bu galw mawr am lo a dur drwy gyfnod y rhyfel byd cyntaf, a blodeuodd y diwydiannau hyn yn Ne Cymru fel ym mhobman arall. Ar ddechrau'r dau-ddegau y cychwynnodd nychdod y fasnach allforio, yn arbennig mewn glo. Daeth diweithdra eang i Dde Cymru. Yn 1923, cyflogid 52 y cant o'r gweithwyr yswiriedig yn y diwydiant glo ond erbyn 1935 yr oedd y rhif hwn wedi cwympo i 37 y cant. Trwy gydol y cyfnod rhwng y ddau ryfel, yr oedd cyfartaledd diweithdra De Cymru yn ddwywaith cymaint â chyfartaledd Prydain gyfan; yr oedd 3 o bob 10 heb waith. Mewn rhai ardaloedd glofaol yr oedd un o bob dau felly.

Yn y dau-ddegau a'r tri-degau ymfudodd llawer iawn o Gymry a'u teuluoedd i ardaloedd llewyrchus yn Lloegr, yn arbennig i'r canoldir ac i gyffiniau Llundain. Amcangyfrifir i ryw 400,000 fynd rhwng 1921 a 1938.

Arweiniodd y dirwasgiad i'r hyn y gallwn ei alw yn Ail Chwyldro Diwydiannol. Gwreiddyn y dirwasgiad oedd llwyr ddibyniaeth economaidd ar ychydig ddiwydiannau trymion. Y feddyginiaeth a'r warant rhag dyfod dirwasgiad o'r un math eto oedd sefydlu diwydiannau newydd amrywiol. Dangoswyd hyn yn glir mewn archwiliad diwydiannol gan Goleg y Brifysgol, Caerdydd yn 1931.

Deddf Ardaloedd Arbennig

Yn 1934 daeth De Cymru, ymhlith ardaloedd dirwasgedig eraill ym Mhrydain, yn rhan o faes cyfrifoldeb Comisiynwr Ardaloedd Arbennig. Ei dasg oedd arfer 'moddion i gynorthwyo datblygiad economaidd a gwelliant cymdeithasol' yr ardaloedd arbennig hyn gyda chymorth cronfa a ddarparwyd dan Ddeddf yr Ardaloedd Arbennig. Un o ganlyniadau ei ymdrechion oedd sefydlu ystad fasnach yn Nhrefforest, ryw saith milltir o Gaerdydd. Adeiladwyd yno ffatrïoedd modern i'w gosod i ddiwydianwyr a oedd rhy llwm eu cyfalaf i wynebu'n hawdd adeiladu'n breifat. Cychwynnwyd adeiladu tua diwedd 1936 ac agorwyd y ffatrïoedd cyntaf yn haf 1937. Yr oedd dros hanner cant o ffyrmiau yno erbyn 1939, llawer ohonynt yn ddiwydianwyr wedi eu herlid o'u gwledydd eu hunain ar y cyfandir. Daethant â dulliau newydd i gynhyrchu nwyddau newydd gan hyfforddi eu gweithwyr, tua 2,000 ohonynt, mewn llawer medr a thechneg newydd.

Yn ychwanegol at ystad Trefforest, agorwyd ffatrïodd bob yn un ac un mewn ardaloedd fel Dowlais, Treorci, Llantarnam, Cwmbrân, Pont-y-pŵl, Caerffili ac

Aberdâr. Cynhyrchwyd ynddynt nwyddau yn amrywio o hosanau sidan a botymau pren i wydr plât a chablenni trydan. Yn y Gogledd, ni bu cynnydd diwydiannol ac eithrio ar lannau Dyfrdwy. Yno, cynyddodd y diwydiant defnydd gwau fel yr enillodd reon ei blwyf. Hefyd, tyfodd cynhyrchu platiau dur yno i gyfateb i'r tyfiant yng ngwaith newydd enfawr Glynebwy yn y De.

Adferiad Cyfnod y Rhyfel

Yr oedd mwy na 100,000 heb waith yng Nghymru yn 1939, sef 15 y cant o'r boblogaeth yswiriedig. Ond prysurodd y rhyfel adferiad economaidd. Daeth galw eto am lo a dur, codwyd ffatrïoedd arfau brenhinol a symudwyd cryn lawer o weithiau i Gymru o ardaloedd mwy peryglus. Erbyn 1943, blwyddyn uchafbwynt cynhyrchu'r rhyfel, yr oedd 130,000 o leiaf o Gymry, yn ddynion a gwragedd, yn gweithio yn eu gwlad eu hunain mewn ffatrïoedd newydd a godwyd oblegid y rhyfel. Yr oedd digon o waith am y tro cyntaf ers chwarter canrif.

Dathlygiadau wedi'r Rhyfel dan nawdd y Ddeddf Dosharthu Diwydiant

Wedi dyfod heddwch yn 1945, collwyd llawer o'r gwaith a dyfodd adeg y rhyfel ac ymddangosodd diweithdra eto yn 1946. Cymerodd Deddf Dosbarthu Diwydiant 1945 le deddfwriaeth yr Ardaloedd Arbennig, a rhoddwyd i'r Bwrdd Masnach y dasg o oruchwylio ail-lunio diwydiant. Nodwyd ardaloedd lle y gellid rhagweld diweithdra difrifol fel Ardaloedd Datblygu, ac, yn ôl y Ddeddf, rhoddwyd i'r Bwrdd Masnach ac i adrannau eraill o'r Llywodraeth yr hawl i godi yn yr ardaloedd hyn ffatrïodd i'w gosod yn rhad i ddiwydianwyr. Ceisiwyd hefyd lesteirio tyfiant pellach diwydiant mewn bröydd gorlawn megis Llundain a Chanolbarth Lloegr trwy wahardd hyd y flwyddyn 1953 godi adeiladau newydd heb drwydded. Haws oedd cael trwydded i adeiladu mewn ardaloedd dathlygu nag mewn ardaloedd gorlawn. Rhaid oedd hefyd i ddiwydianwyr a oedd yn bwriadu adeiladu roi gwybod i'r Bwrdd Masnach. Felly rhoddwyd siawns i'r Bwrdd egluro manteision a gofynion yr Ardaloedd Datblygu i bob un ohonynt.

Newidiwyd y ddwy ffatri Arfau Brenhinol yng Nghymru, y naill yn Hirwaun a'r llall ym Mhen-y-bont ar Ogwr, i fod yn ystadau masnach. Felly'n union gydag un lai yn Wrecsam, ac adeiladwyd ystad fasnach newydd sbon yn Fforestfach, ger Abertawe. Dosbarthwyd llawer o sefydliadau rhyfel llai y Llywodraeth rhwng diwydianwyr. Trwy hyn a hefyd trwy adeiladu ffatrïoedd newydd ar gost y Llywodraeth ar safleoedd arbennig hwnt ac yma, cywirwyd i raddau helaeth, brinder adeiladau diwydiannol a gostyngwyd diweithfdra i lefel isel erbyn dechrau'r pum-degau.

Yr oedd Ystadegau Diwydiannol Cymry a Mynwy Cyf., wedi adeiladu ac addasu 13,838,723, o droedfeddi sgwâr o lawr ffatri erbyn 1959. Sefydlwyd y corff hwn yn 1936 dan nawdd Comisiynwr yr Ardaloedd Arbennig a thrwy Ddeddf Dosbarthu Diwydiant 1945 daeth i weithredu fel cynrychiolydd y Bwrdd Masnach. Cyflogai'r 343 o ffyrmiau diwydiannol a ddaliai'r ffatrïoedd hyn tua 61,000 o bersonau. Yr oedd 932,000 troedfedd sgwâr yn rhagor o lawr ffatri ar waith gan yr adeiladwyr yng Ngorffennaf 1959.

Yn ogystal â'r newid a ddilynai'r cyfle a roddwyd i gael gwaith mewn gwneud nwyddau amrywiol o fath newydd, gwelodd blynyddoedd wedi'r rhyfel newid dirfawr hefyd yn yr hen ddiwydiannau, sef y diwydiant glo a dur a phlatiau alcam.

Datblygiadau wedi'r Rhyfel yn y Diwydiant Glo

O ganol y bedwaredd ganrif ar bymtheg, tyfodd y diwydiant glo yn gyson nes cyrraedd pen-llanw yn 1913 yng Nghymru. Yn y flwyddyn honno, trwy lafur 275,000 ym meysydd glo De Cymru, cloddiwyd tua 57 o filiynnau o dunelli o lo ac allforiwyd tua 35 o filiynnau o'r rhain. Erbyn 1946, cwympodd nifer mintai'r llafurwyr i tua 100,000 a'u cynnyrch i 20 o filiynnau o dunelli; collwyd y fasnach allforio bron yn llwyr. Cenedlaetholwyd y diwydiant glo yn 1947; lluniwyd rhaglen dros bymtheng mlynedd i ail-drefnu'r diwydiant yng Nghynllun 1950 y Bwrdd Glo Cenedlaethol. Yn 1956 adolygwyd y sefyllfa gyffredinol mewn cyhoeddiad arall—'Buddsoddi mewn Glo'—ac yn hwn hysbyswyd bwriad y Bwrdd Glo i wario £1,000,000,000 hyd 1965 i ail-drefnu pyllau Prydain. Yr oedd y ddegfed ran o hyn wedi ei neilltuo ar gyfer meysydd glo De Cymru, mwy nag ar gyfer unrhyw faes glo arall ym Mhrydain.

Eisoes, dan y cynlluniau newydd, y mae dros 70 o byllau De Cymru wedi eu cau, pyllau lle yr oedd codi'r glo yn ôl barn y Bwrdd yn rhy ddrud. Cychwynnwyd pyllau newydd a diwygiwyd dulliau gwaith rhai eraill drwy ddefnyddio cloddio gorwel a thechnegau modern eraill. Peirianeiddiwyd y pyllau yn fwyfwy, i wneud y cloddio a'r cludo'n haws; crynhowyd gweithwyr i'r mannau gorau i gael yr elw mwyaf o ddyn a pheiriant; dyfeisiwyd cynlluniau i dderbyn a hyfforddi'r ifanc mewn maes glo a redwyd am flynyddoedd ar lafur rhai hŷn. Bwriedir codi cynnyrch y maes i 26 o filiynnau o dunelli erbyn 1965. Yn 1958, cloddiwyd 23,280,000 tunnell ym maes glo De Cymru a 2,470,000 ym maes Gogledd Cymru; amcangyfrifwyd bod 119,550 o weithwyr yswiriedig ym meysydd y De a'r Gogledd, sef lleihad o 14,580 er 1948.

Cynhyrchu Dur a Phlatiau Alcam wedi'r Rhyfel

Y mae dulliau cynhyrchu dur a phlatiau alcam wedi eu gweddnewid er y rhyfel trwy ddyfodiad melinau strip di-dor a pheiriannau rhydwytho oer. Y mae gweithiau dur a phlatiau alcam enfawr Cwmni Dur Cymru ym Margam (Aberafan), Trostre (Llanelli) a Felindre (ger Abertawe) gyda'r datblygiadau unigol mwyaf yn Ewrop er y rhyfel. Yn y canolfannau dur, Glynebwy, Dowlais, Caerdydd a Chasnewydd a Glannau Dyfrdwy, y mae cynlluniau moderneiddio ar waith neu wedi ei gorffen. Yn 1958, cyflogwyd 59,626 yn y diwydiant dur a haearn (heb gyfrif platiau alcam), cynnydd o 32·4 y cant er 1948. Heb gyfrif platiau alcam eto, cynhyrchwyd 9,111,041 tunnell o ddur a haearn yn 1958, cynnydd o 83·6 y cant er 1948. Yn 1958, daeth 89 y cant o gynnyrch Prydain o ddur llafn o Dde Cymru, 21 y cant o blatiau dur a 29 y cant o ddur amrwd.

Rhwng y ddau ryfel, bu newid sylweddol yn nhrefn y diwydiant platiau alcam gan i nifer o gwmnïau bach, a arferai weithio ar wahân gyfuno. Cychwynnodd melin strip llydan gyntaf Prydain ar waith yng Nglynebwy yn 1938, a dyma, ynghyd â melinau rhydwytho oer i wneud sitennau a phlatiau alcam, oedd dechrau diwedd defnyddio yr hen ddulliau traddodiadol o wneud platiau alcam. Erbyn hyn, y mae'r hen felinau llaw bron wedi llwyr ddiflannu. Ni allent gyd-fyw â gweithiau enfawr Margam, Trostre a Felindre a gweithiau eraill a ehangwyd. Y mae'r dulliau newydd wedi codi maint y cynnyrch yn sylweddol, er cyflogi llai o weithwyr. Rhwng 1948 a 1958 cododd cynnyrch platiau alcam 44·8 y cant i 1,036,200 tunnell y flwyddyn ond cwympodd nifer y gweithwyr 41·5 y cant i 9,910. Daeth 99 y cant o blatiau alcam Prydain o Gymru yn 1958.

Alwminiwm ac Aloeon Ysgafn

Yn fuan ar ôl i waith toddi alwminiwm cyntaf Prydain ddechrau ar waith yn yr Alban, codwyd gwaith tebyg yn Nolgarrog ger Conwy a dechreuwyd toddi alwminiwm a chynhyrchu llen-fetel yno yn 1908. Felly y bu hyd ail hanner y tri-degau pryd y tyfodd y galw am offer alwminiwm ac y bu symud ymlaen yn Ne Cymru. Fel y llyncai arfau rhyfel fwy o'r metal ac o'i aloeon, cododd y cynnyrch ac erbyn diwedd y rhyfel yr oedd chwe gwaith alwminiwm wedi codi yn Ne Cymru. Erbyn hyn, y maent oll wedi ehangu a chyda'r mwyaf llewyrchus ym Mhrydain. Cynyddodd y galw am alwminiwm a'i aloeon ar ôl y rhyfel—o 1948 i 1958 cododd cynnyrch Cymru 63 y cant i 86,787 tunnell, 40 y cant o holl gynnyrch Prydain.

Peirianneg

Tyfodd y diwydiannau ysgafn peirianegol hefyd ar ôl y rhyfel, gan gynnwys peirianneg drydanol. Cychwynnwyd rhai ffatrïoedd newydd i wneud offer tai a chegin ac y mae rhagor yn cael eu codi yn awr. Y mae un cwmni offer trydan a ddechreuodd weithio yn Ne Cymru gyda 30 o ddynion yn 1941 yn awr yn cyflogi 1,800 ac yn derhyn 80 prentis y flwyddyn. Cyflogir 3,500 gan ddau gwmni gwneud offer tŷ a chegin a ddaeth i Gymru ar ôl y rhyfel. Yn y Gogledd Ddwyrain, newydd ddyfodiad pwysig yw'r diwydiant gwneud awyrennau. Cychwynnwyd yn 1948 gyda 120 o weithwyr ond yn awr cyflogir dros 5,000.

Diwydiannau Cemegol a'u Tebyg

Tyfodd y diwydiannau hyn yn rhyfeddol yng Nghymru yn yr ugain mlynedd diwethaf. Yn 1937, yr oedd eu mintai waith dipyn yn llai na 10,000 ond erbyn 1948 cododd i 19,700 ac i 25,110 yn 1958. Bu gweithiau mân, yma a thraw, yn gwneud cemicalau yng Nghymru ers canrif ond yn ddiweddar y tyfodd y mân weithiau yn ddiwydiant pwysig a llewyrchus. Er 1945, tyfodd yr hen weithiau a chychwynnwyd llawer gwaith newydd. Y mae un ohonynt yn ymledu dros gan cyfer o dir yn y Barri ym Morgannwg ac yn un o'r ffatrïoedd plastig crai mwyaf ym Mhrydain. Gan fod dulliau cemegol yn gwreiddio'n ddyfnach o hyd yng nghraidd poh math o ddiwydiant hron, mae'n dehyg y dyry y diwydiant cemegol gadernid cynyddol i drefn ddiwydiannol Cymru.

Dechreuwyd puro olew yn Llandarcy ger Castell-nedd yn 1922, mewn purfa fawr, y gyntaf ym Mhrydain i drin olew amrwd. Yn y dau-ddegau cynnar, gweithiai'r hurfa yn rhannol ar olew amrwd ac yn rhannol ar olew hanner coeth a gludwyd o Bersia i'w ail-ddistyllu'n hylif pur megis gwirod modur a cherosîn. Yn ddiweddarach, codwyd gwaith i gynhyrchu gwell gwirod modur a mwy ohono a hefyd gwaith i gynhyrchu olew iro. Yn 1939, cynhyrchai'r hurfa tua 360,000 tunnell y flwyddyn. Ar ôl y rhyfel i ateb gofynion cartref cynyddol, ehangwyd i drin 2,500,000 tunnell o ddefnydd crai y flwyddyn a chodwyd hyn eto i 3,000,000 tunnell. Gweithiaï 2,500 yno o gymharu â 1,000 ar ddechrau'r rhyfel. Y mae cynlluniau puro ac ystorio olew yn Aherdaugleddau yn mynd i achosi codi eto gynnyrch a nifer gweithwyr y diwydiant hwn.

Y Diwydiant Defnydd Gwau

Erbyn hyn y mae 1·7 y cant o holl weithwyr Cymru yn y diwydiant hwn. Y mae'r diwydiant hwn wedi gweld cymaint tro ar fyd ag un yn ystod yr ugain mlynedd diwethaf yn wyneh dathlygu'r amrywiaeth o edefyn gwneud. Yn 1958 yr oedd 11,500 (70 y cant) o weithwyr y diwydiant gwau yn nyddu a gwau edefyn gwneud a dim ond 730 yn trin brethyn gwlân. Mae hyn yn arwydd o'r newid a'r tyfiant. Erbyn hyn y mae'r diwydiant yn llanw 4,500,000 troedfedd sgwâr o lawr ffatri.

Y Newid yn ystod yr Ugain Mlynedd Diwethaf

Mae treigliad ugain mlynedd wedi gweld lleihau'n gyson gyfartaledd llafurwyr diwydiannau trwm, glo, dur, haearn, a chodi nifer llafurwyr diwydiannau gwneud nwyddau. Yn atodiad G. rhoddir amcangyfrif o'r manylion. Dyma yn awr rai enghreifftiau o fesur y cynnydd yn nifer y gweithwyr:

> Peirianneg adeiladu, 96 y cant; gwneud setiau derbyn darlledu a theledu, 162 y cant; gwneud a thrwsio clociau a watsis, 128 y cant; gwneud rhwber, 579 y cant; cynhyrchu pwer trydan, 70 y cant; trwsio ceir a gwaith garej, 30 y cant; gwneud papur, 47 y cant; masnach dosbarthu, 13 y cant; gwasanaethau proffesiynol, 31 y cant.

Cyn yr ail ryfel byd, enillai tua 40 y cant o weithwyr yswiriedig Cymru eu bywoliaeth yn y diwydiannau trymion a thua 12 y cant mewn diwydiannau cynhyrchu. Yn 1948, y ddau ffigur oedd 22 a 20 y cant, yn 1958 21 a 24 y cant. Felly cyn y rhyfel ceid tri mewn diwydiant trwm am bob un mewn diwydiant cynhyrchu ond yn 1958 yr oedd mwy yn gweithio ar waith cynhyrchu nag yn y diwydiannau trymion. Y mae cynnydd y diwydiannau cynhyrchu, sydd yn awr yn rhoi ei fara beunyddiol i bron un o bob pedwar o weithwyr Cymru, yn arwydd o lwyddiant polisi'r Ardaloedd Arbennig a'r Ardaloedd Datblygu.

Yn yr un cyfnod edwinodd rhai o'n diwydiannau, yn arbennig gwaith adeiladu, y diwydiant llechi a masnach y dociau. Mewn adeiladu cyflogwyd 79,480 yn 1938, 66,030 yn 1948 a 62,060 yn 1958. Yn y chwareli llechi gweithiai 8,490, 4,680 a 3,330 yn yr un blynyddoedd hyn a gostyngodd eu cynnyrch o 219,000 tunnell i 106,000 tunnell ac i 69,000 tunnell. Triniwyd 24,790,000 tunnell o nwyddau yn nociau mwyaf Cymru yn 1938, cwympodd i 13,461,000 tunnell yn 1948 ond cododd i 16,934,000 tunnell yn 1958, yn bennaf oblegid cynnydd ym masnach dociau Abertawe.

Yn yr un tair blynedd, dyma ffigurau masnach y porthladdoedd mewn glo ac olew sef 19,433,000, 6,752,000, 3,444,000 tunnell o lo a 524,000, 1,241,000 a 3,830,000 tunnell o olew. Erbyn hyn, felly, cludir mwy o olew nag o lo trwy borthladdoedd Cymru.

Rhan Gwragedd mewn Diwydiant

Cymerodd gwragedd Cymru ran sylweddol yn nhyfiant diwydiannol yr ugain mlynedd olaf hyn. Pan gyrhaeddodd cynhyrchu rhyfel ei uchafbwynt, yr oedd 125 y cant o wragedd yn fwy na chyn y rhyfel yn gweithio yng Nghymru. 30 y cant oedd cyfartaledd cyfatebol Prydain ben baladr. Creodd gofynion rhyfel felly fintai waith o wragedd Cymru sydd yn llawer mwy na chyn y rhyfel. Yn 1937, dim ond dwy wraig a geid ymhlith pob 17 o weithwyr yswiriedig Cymru ond yn 1958 ceid dwy o bob saith. Pwysig nodi fod y cynnydd yng nghyfanrif gweithwyr yswiriedig Cymru rhwng 1948 a 1958, sef 32,470, yn cynrychioli cwymp o 1,780 o ddynion ar y naill law, a chynnydd o 34,250 o wragedd ar y llaw arall.

Yr oedd cyfanrif y gwragedd a oedd mewn gwaith yswiriedig yng Nghymru yn 1958 yn 269,000 o blith 952,000 o weithwyr yswiriedig. Dyma fel y rhannwyd y nifer hwn rhwng gwahanol adrannau diwydiant. Dengys y ffigur mewn cromfachau gyfartaledd y gwragedd yn y diwydiant arbennig hwnnw:

> diwydiannau gwneud nwyddau, 70,000 (31 y cant); gwahanol wasanaethau, 51,600 (76 y cant); masnach ddosbarthu, 50,400 (54 y cant); gwasanaethau proffesiynol, 50,000 (66 y cant); Llywodraeth Genedlaethol a lleol, 16,400 (25 y cant).

Er yr holl gynnydd, amharod yw diwydiant i gynnig i ferched holl gyfle a gobaith bechgyn sy'n fedrus fel crefftwyr, technegwyr neu dechnolegwyr. Er enghraifft, y mae'r diwydiant cemegol, a'i debyg, yn derbyn merched cymwys fel technegwyr labordai neu gynorthwywyr mewn labordai ymchwil, ond ychydig o siawns a gobaith sydd iddynt godi i swyddi cyfrifol fel rheolwyr neu arolygwyr. Yn y diwydiant peiriannol derbynnir rhai merched fel lluniadwyr neu dreswyr. Ychydig iawn o sylw difrifol a roddwyd hyd yma i dderbyn merched gyda'r bwriad o'u paratoi ar gyfer cymwysterau proffesiynol mewn peirianneg.

Mewn cyfnod o gryn siarad am brinder rhai cymwys mewn gwyddoniaeth a thechnoleg i ateb gofynion diwydiannau sy'n ehangu ac adrannau gwyddonol y llywodraeth, oni ddylid rhoi mwy o sylw i'r stôr o allu gwyddonol a thechnolegol sydd eto heb ei ddatblygu ymhlith merched? Er bod rhai meistri gwaith yn barod i gynnig i ferched yr un cyfle ag i fechgyn i fynychu colegau technegol i ennill cymwysterau technegol, mae'n amheus a yw hyd yn oed y rhain yn annog merched o ddifrif i gymryd y camre hyn.

Mae'n debyg mai un rheswm am agwedd fel hon, sydd heb fod yn frwd nac yn oer, yw'r 'gwastraff' o safbwynt diwydiant sydd yn dilyn priodi. Dywedodd un diwydiannwr wrth y Cyngor mai cyfartaledd hyd oes merch mewn diwydiant oedd tair blynedd ac am hynny fod gwario arian ar gynlluniau i hyfforddi merched yn wario i bwrpas ansicr. Barn gibddall yw hon yn sicr. Canys y mae'n debyg y byddai llawer merch yn ail-gydio mewn gwaith proffesiynol ar ôl i'w phlant dyfu fel y mae gwragedd priod yn awr yn ail-ddechrau fel athrawesau ysgol.

Efallai nad yw'r merched eu hunain yn awyddus i geisio gwaith medrus a chyfrifol mewn diwydiant, gwaith sydd yn gofyn prentisiaeth a hyfforddiant, oblegid y gred draddodiadol mai lle dynion yw uchelfannau diwydiant. Gwir hyn yn arbennig felly yng Nghymru oblegid hyd yn ddiweddar diwydiannau trymion oedd yma heb lawer o le ynddynt i wragedd. Erbyn hyn y mae gwell cyfle ac y mae mwy o wragedd mewn gwaith diwydiannol. Ond o hyd y mae eu hagwedd at eu gwaith yn aros yn wahanol i agwedd arferol dynion o gyraeddiadau tebyg. Y mae dyn ieuanc yn disgwyl ac yn bwriadu dod yn ei flaen mewn diwydiant. Y mae'r rhan fwyaf o ferched ieuanc yn fodlon ar lanw amser. Credwn ni y gellid newid eu hagwedd o newid yn gyntaf y farn gyffredinol ddi-sylwedd a rhagfarnllyd honno sydd yn tybio na all merched elwa ar addysg wyddonol a thechnegol gan gymryd yn ganiataol fod merched yn astudio pynciau'r Celfyddydau gyda mwy o lwyddiant na phynciau Gwyddonol. Ond yn bwysicach na dim, fe ddigwyddai'r newid hwn pe ceid llawer iawn mwy o athrawon o radd uchel mewn gwyddoniaeth a mathemateg mewn ysgolion merched. Yn ddios, y mae prinder a diffyg athrawon addas mewn gwyddoniaeth a mathemateg mewn ysgolion gramadeg i ferched wedi peri i nifer y merched sydd yn dilyn y cyrsiau yma i lefel Gyffredinol a lefel uwch y Dystysgrif Addysg Gyffredinol aros yn isel. Yn atodiad N, gwelir fod chwe gwaith cymaint o fechgyn ag o ferched wedi eistedd Arholiad Uwch y Cyd-bwyllgor Addysg Cymreig yn 1958 mewn mathemateg a ffiseg. Gellid gwella tipyn ar hyn pe ceid gwell cydweithrediad rhwng ysgolion gramadeg i fechgyn a rhai i ferched mewn ardaloedd cyfagos lle y byddai'n gyfleus i uno dosbarthiadau'r chweched dosbarth yn y pynciau hyn ac o bosibl mewn pynciau eraill hefyd.

Os oes datblygu i fod ar y ffynhonnell hon o allu gwyddonol a thechnolegol i ateb gofynion y wlad, bydd yn rhaid i ddiwydianwyr newid eu ffyrdd a'u holl agwedd ynglyn â derbyn gwragedd a merched. Bydd yn rhaid i ysgolion hefyd annog rhagor o ferched i ddarllen mathemateg a gwyddoniaeth fel eu prif bynciau, yn enwedig merched â'u bryd ar fod yn athrawon.

Yr Angen am fwy o Amrywiaeth

Gwelodd yr ugain mlynedd diwethaf hyn, felly, newid llwyr yng nghorff diwydiannol Cymru. Ail-wampiwyd diwydiannau glo, dur a phlatiau alcam a'u dwyn i gyflwr newydd effeithiol a modern, ac ychwanegwyd atynt lu o ddiwydiannau gwneud, sydd trwy eu hamrywiaeth yn cryfhau economi'r wlad. Pe gellid amrywio mwy, drwy ddenu diwydiant sydd â lle go fawr ynddo i lafur medrus, megis gwneud moduron ac awyrennau, byddai'r economi ar sail dipyn cadarnach.

Gellir cefnogi hyn nid yn unig ar sail economaidd ond hefyd ar sail gymdeithasol. Canys nid yw Cymru'n brin o ddynion a chanddynt grefft a medr—yn hytrach cynigir cyfle rhy brin i'r rhain fyw eu bywyd yng Nghymru. Gyda mwy o amrywiaeth diwydiannol, gallai'r ieuainc a feddai'r gallu i dderbyn hyfforddiant fel technegwyr a thechnolegwyr ddisgwyl gwaith yng Nghymru heb orfod ymfudo i chwilio amdano. Canlyniad hyn yn awr yw fod Cymru'n colli nid yn unig fedr a gallu ond arweinwyr naturiol amrywiol gylchoedd ei bywyd, anadl einioes ei chymdeithas.

Y mae llawer wedi cymryd rhan yn y gwaith a wnaethpwyd eisoes i lywio'r ail Chwyldro Diwydiannol hwn; Adrannau arbennig o'r Llywodraeth; Awdurdodau Lleol; Aelodau Seneddol a chyrff fel Bwrdd Diwydiant Cymru, Cymdeithas Ddiwydiannol Cymru a Mynwy, Pwyllgor Cenedlaethol Datblygu Diwydiannol Cymru a Mynwy a Chyngor Datblygu Economaidd Cymru.

PENNOD III

Patrwm Addysg Dechnegol Heddiw

Y mae diwydiant yn datblygu'n fwy-fwy cymhleth a dulliau'n newid dan bwys cyson techneg newydd. Am hynny rhaid wrth weithwyr ystwyth eu gallu i feistroli'r newid. Bydd newid dulliau cynhyrchu, megis trwy automatiaeth, o bosibl yn gofyn am ad-drefnu'r fintai waith. Mae mecaneiddio ac automatiaeth yn lleihau'r galwad am waith peiriannol, digyfnewid sy'n cael ei wneud yn bennaf gan weithwyr anfedrus neu lled-fedrus. Ar y llaw arall, y mae'r peiriannau eu hunain yn gofyn am grefftwyr medrus i'w trin a'u trwsio. Am hynny, tuedd y datblygiad yma yw codi'r gofyn am weithwyr medrus ar draul y gofyn am rai anfedrus. Ar lefel uwch, rhaid i'r peirianwyr a'r gwyddonwyr sydd yn llunio a datblygu'r peiriannau cymhleth wrth fedr a dyfais arbennig iawn. Felly pwysig odiaeth yw i gyfansoddiad y fintai waith adlewyrchu cydbwysedd teg rhwng ymchwil, datblygu a chynhyrchu. A dylai trefn addysg roi sicrwydd, hyd y gall system roi sicrwydd, fod gweithwyr diwydiannol yn ddigon ystwyth eu gallu i feistroli'r newid mewn techneg ac mewn dulliau cyffredinol.

Y mae categorïau gwahanol o weithwyr medrus mewn diwydiant. Dyma'r dosbarthiad arferol:

technolegwr, technegwr, crefftwr, gweithydd.

Rhoddwyd llawer cynnig ar ddiffinio'r categorïau hyn. Rhaid i ninnau, er mwyn bod yn glir, sylwi'n fanwl ar y gwahanicaethau rhyngddynt. Felly nodwn ddiffiniadau'r Papur Gwyn ar Addysg Dechnegol o dechnolegwr a thechnegwr.

> ‘Bydd gan *dechnolegwr* gymwysterau a phrofiad o'r safon sy'n angenrheidiol i fod yn aelod o sefydliad proffesiynol. Bydd y rhan fwyaf o raddedigion prifysgol mewn peirianneg a gwyddorau ymarferol eraill a chyfran dda o rai a enillodd Ddiploma neu Dystysgrif Genedlaethol Uwch neu gymwysterau tebyg, yn dyfod yn dechnolegwyr. Mae technolegwr wedi astudio egwyddorion sylfaenol ei dechnoleg ddewisol a dylai fedru defnyddio'i wybodaeth a'i brofiad i roi datblygiadau ymarferol ar droed. Disgwylir iddo dderbyn cyfrifoldeb go fawr ac yn aml ehangu terfynau gwybodaeth yn ei faes arbennig ef ei hun.
>
> Y mae *technegwr* yn gwymwys, yn rhinwedd ei addysg a'i brofiad o waith ymarferol, i weithio'n uniongyrchol dan gyfarwyddyd cyffredinol technolegwr. Felly rhaid fod ganddo wybodaeth drwyadl o wyddoniaeth ac o fathemateg, sy'n berthnasol i'w briod faes. Mae cynllunwyr cynorthwyol a rheolwyr iau ar lawr y gwaith yn enghreifftiau o dechnegwyr yn y ffatri Hyfforddir *crefftwr* yn nhechneg safonol diwydiant. Y mae'n wahanol i weithydd mewn dau beth o leiaf. Rhaid iddo ddeall pam yn ogystal a gwybod sut y mae peiriannau'n rhedeg. Rhaid iddo hefyd fedru gwneud rhannau o beiriant a'u cydosod heb gymorth mwy na disgrifiad technegol neu luniadau peirianegol ohonynt. Ei gymhwyster sylfaenol yw bwrw ei brentisiaeth, ond y mae'r gofyn ar gynnydd mewn rhai diwydiannau am dystiolaeth ar bapur megis tystysgrifau'r *City and Guilds*.
>
> Trin peiriannau unigol a pheiriannau rhes yw priod waith *gweithydd*—gwaith sydd heb ofyn medr crefftwr na'i ddysg a'i brofiad. Y mae safon medr a hyd cwrs hyfforddiant gweithydd yn amrywio'n fawr o'r naill ddiwydiant i'r llall.

Yn ychwanegol at dderbyn profiad ymarferol mewn diwydiant, bydd y technolegwr a'r technegwr wedi mynychu cyrsiau addysgol mewn colegau technegol cyn cyrraedd eu braint. Mae cyrsiau felly yn cyd-redeg â hyfforddiant ymarferol mewn diwydiant ond y mae rhai technolegwyr yn dilyn cyrsiau gradd prifysgol cyn dechrau ar hyfforddiant ymarferol.

Da yw nodi fod erbyn hyn fwy o duedd i grefftwyr hefyd ddilyn cyrsiau mewn coleg technegol. Ond yn anaml y digwydd hyn i'r gweithydd er bod rhai enghreifftiau yn y diwydiannau glo, haearn, dur a chemeg.

Gelwir gweithiwr sydd dan hyfforddiant mewn diwydiant ar gyfer bod yn grefftwr neu dechnegwr neu dechnolegwr yn brentis crefft neu'n brentis heb raddio neu'n brentis graddedig, yn y drefn hon.

Prentisiaid Crefft

Derbyniad

Derbynnir prentisiaid crefft fel arfer rhwng pymtheg a dwy ar bymtheg oed i brentisiaeth sy'n ymestyn dros bum mlynedd. Mae safon eu deall a'u medr yn amrywio cryn lawer, felly befyd safon ac ansawdd yr hyfforddiant ymarferol a gynigir iddynt mewn diwydiant. Yn sicr y mae amrywiaeth mawr rhwng safon medr gwahanol ddiwydiannau ond ychydig sylw a gaiff y ffaith ganolog hon yn newisiad, neu hyfforddiant neu statws terfynol y crefftwr.

Gwir fod cyflogwyr yn gwneud mwy o ddefnydd o'r Gwasanaeth Cyflogi Ieuenctid nag o'r blaen, ond eto mae lle i gredu bod llawer ohonynt heb unrhyw wybodaeth o'r cymorth a rydd y Gwasanaeth hwn, drwy ddod â chyfle a rhagolygon diwydiant modern i sylw'r disgybl pan fo'n gadael ysgol a thrwy gasglu enwau a hanes rhai addas i'w derbyn yn brentisiaid crefft.

Wrth gwrs y mae a fynno nifer y prentisiaid crefft a dderbynnir gan gwmni neu gorfforaeth â pharodrwydd y cwmni i wynebu'r draul hyfforddi ac â hwylustod darpariaeth hyfforddi y cwmni. Ni all rhai cwmnïau bychain gynnal prentisiaid. Felly edrychant am grefftwyr cyflawn a hyfforddwyd gan eraill. Mewn rhai ardaloedd osgowyd yr anawsterau hyn trwy gychwyn cynlluniau prentisiaeth grŵp. Mewn cynllun felly bydd nifer o ffyrmiau yn cyd-weithio i roi hyfforddiant cynhwysfawr i brentisiaid drwy eu danfon o un gwaith i'r llall a thrwy hyn elwa ar ymarfer mwy eang nag ymarfer unrbyw un o'r gweithiau ar ei ben ei hun. Gweithredir y rhan fwyaf o gynlluniau felly yng nghanoldir Lloegr a chyffiniau Llundain. Nid oes cynllun o'r fath yng Nghymru eto. Buasai rhai ardaloedd, megis ardaloedd ag ystad fasnach yn gnewyllyn ynddynt, i bob golwg yn aeddfed i gynllun o'r math hwn.

Gall rhwystr arall godi oblegid rheolau Undebau Llafur a fydd yn cyfyngu ar nifer y prentisiaid a dderbynnir ac yn pennu uchafrif. Pwrpas rheolau fel hyn yw amddiffyn y fintai waith fedrus a phrofiadol rhag y nycbdod a'r gwendid a ddilynai dderbyn prentisiaid yn ddi-rwystr a chymryd mantais ohonynt. Bernir hefyd y byddai derbyn gormod yn llesteirio hyfforddiant teilwng a disgyblaeth ddigonol. Felly, ni chaiff ffyrm dderbyn yn brentisiaid mewn galwedigaeth arbennig fwy na chyfran benodedig o'r holl grefftwyr medrus neu weithwyr yn ôl y dydd a gyflogir gan y ffyrm yn yr alwedigaeth bonno. Mae'r cyfartaledd penodedig yn amrywio o un alwedigaeth i'r llall ac y mae cyfartaledd arbennig yn cael ei phennu ar gyfer ffyrm arbennig ac nid ar gyfer galwedigaeth yn gyffredinol dros yr holl wlad. Pwysig hyn, canys nid yr un fyddai'r cyfartaledd pe seilid ef ar ystadegau'r wlad trosti yn gyfan.

Danfonwyd gennym holiadur at feistri gwaith Cymru sydd yn cyflogi cant neu fwy o weithwyr ac i gyfran sef 25 y cant o'r rhai sy'n cyflogi rhwng deg a chant (gweler Atodiad M). Dyma'r atebion:

Diwydiannau Preifat (h.y. heb eu cenedlaetholi)

Nifer y Cyflogwyr y danfonwyd atynt ...	628
Y Nifer a atebodd	350

	1955	1956	1957
(i) Nifer y lleoedd i brentisiaid crefft	1,320	1,329	1,323
(ii) Nifer a dderbyniwyd i'w llenwi	1,280	1,301	1,319

(iii) Amcangyfrif o'r derbyniad blynyddol yn ystod 1958-62 697

Diwydiannau a Genedlaetholwyd

Y nifer y danfonwyd atynt	10
Y nifer a atebodd	10

		1955	1956	1957
(i) Nifer y lleoedd i brentisiaid crefft		421	481	581
(ii) Nifer a dderbyniwyd i'w llenwi		404	481	559
(iii) Amcangyfrif o'r derbyniad blynyddol yn ystod 1958-62	325			

Y mae'r cynnydd yn nifer lleoedd gwag diwydiannau a genedlaetholwyd yn y cyfnod 1955-57 i'w briodoli i'r Bwrdd Glo sy'n derbyn hanner holl brentisiaid crefft y diwydiannau hyn.

Ni all yr amcangyfrif uchod o ofyniadau'r dyfodol fod yn fanwl gywir o du'r diwydiannau preifat gan na chafwyd ateb i'r cwestiwn hwn gan bawb. (Er enghraifft derbyniodd diwydiant adeiladu yn Ne Cymru 556,514 a 414 o brentisiaid yn 1955, 56 a 57, ond ni roddodd yr atebion amcangyfrif am y dyfodol). Er hyn, dengys yr atebion fod yn rhaid disgwyl cwymp sylweddol yn rhif y prentisiaid crefft a dderbynnir yn flynyddol yn ystod 1958-62 o gymharu â 1955-57. Yr un oedd byrdwn tystiolaeth bersonol dros gant o ddiwydianwyr a fu'n siarad â'r Cyngor ac am hynny y mae'n wir am holl faes diwydiant Cymru.

Hyfforddiant

Y mae prentis yn derbyn hyfforddiant ymarferol ei grefft yn y gwaith ac yn cael dysgu technoleg ei grefft a phynciau perthnasol yn y coleg technegol. Yn y cwrs coleg fel rheol, bydd hyfforddiant ymarferol perthnasol i'r cwrs wedi ei drefnu a'i ddethol yn ofalus i ateb gofynion crefft arbennig gan y *City and Guilds of London Institutes* neu gan Gorff Arholi Rhanbarthol megis *The Union of Lancashire and Cheshire Institutes*. Gwneir hyn oll gyda chydweithrediad diwydiant. Bydd rhai diwydiannau, er mai ychydig ydynt yng Nghymru, yn cynnal Ysgolion Hyfforddi Gwaith lle y dilyn y prentisiaid gyrsiau amser llawn o ddysgu ac o hyfforddiant ymarferol am gyfnod cyntaf o tywle rhwng chwe mis a dwy flynedd. Fel arfer cânt hefyd ryddhad dydd i ddilyn cyrsiau coleg technegol yn ystod yr amser hwn.

Rhaid sylwi'n arbennig ar drefn y Bwrdd Glo, trefn a gychwynnwyd yn 1954 ar gyfer peirianwyr pwll a thrydanwyr pwll. Treulir blwyddyn gyntaf prentisiaeth o bum mlynedd yn llwyr mewn coleg technegol. Am hanner yr amser hwn, sef dau ddiwrnod a hanner yr wythnos, bydd y coleg technegol yn gweithredu fel Ysgol Hyfforddi Gwaith ac am yr hanner arall dysgir egwyddorion sylfaenol y grefft a phynciau addysgol cyffredinol. Yn yr ail flwyddyn, bydd y prentis yn y coleg ddeuddydd yr wythnos ac ar un o'r ddau caiff hyfforddiant ymarferol. Am dair blynedd ymhellach, sef gweddill ei brentisiaeth, bydd yn y coleg am undydd yr wythnos ac weithiau un noson hefyd yn paratoi ar gyfer arholiad y *City and Guilds* neu'r Dystysgrif Genedlaethol. Bydd y Bwrdd Glo yn talu'r awdurdod addysg lleol am ran ddiwydiannol ac ymarferol cwrs y prentis yn y coleg.

Erbyn hyn y mae'r rhan fwyaf o ffyrmiau yn cynnig rhyddhad dydd heb golli cyflog i'w prentisiaid fel y gallont ddilyn cwrs pwrpasol mewn coleg technegol am un dydd yn yr wythnos. Weithiau caniateir hyn hyd nes y bo'r prentis yn 21 oed, weithiau daw i ben pan fo'n 18 oed. Datblygiad diweddarach yw rhyddhad cryno (gweler tudalen 78). Dan y drefn hon bydd prentis yn mynychu cwrs amser llawn mewn coleg am ddau neu dri chyfnod gwahanol mewn blwyddyn o fis yr un. Yng Nghymru, cychwynnwyd hyn yn Sefydliad Amaethyddiaeth Brynbuga yn 1948 i brentisiaid o ofaint. Symudwyd y cwrs i Sefydliad Dechnegol y Drenewydd yn 1953. Gan fod y nifer yng Nghymru'n fychan, rhy ddrud yw trefnu cwrs rhyddhad dydd mewn colegau technegol lleol ym mhob rhyw ardal ac am hynny trefnir cwrs cryno yn y Drenewydd er mwyn Cymru gyfan. Bydd prentisiaid yno yn dilyn cwrs amser-llawn am ddau gyfnod o fis yr un ym mhob un o flynyddoedd eu prentisiaeth.

Yn 1954 cychwynnwyd cwrs cryno yng Ngholeg Technegol Llandaf i brentisiaid Gwresogi ac Awyru. Cyn hyn cynhelid cwrs rhyddhad dydd yng Ngholeg Technegol Caerdydd, ond nid oedd hyn yn gyfleus gan fod eu gwaith beunyddiol yn dwyn y prentisiaid ymhell o Gaerdydd. Yn awr byddant yn dilyn cwrs amser-llawn yn Llandaf am fis ymhob tymor am bedair blynedd. Cychwynnodd deg ar y cwrs ym mis Medi 1954 a'i gwblhau ym mis Mehefin 1958. Buont oll yn llwyddiannus yn arholiad Tystysgrif Derfynol y *City and Guilds*. Yr oedd hyn yn welliant sylweddol ar ganlyniadau blynyddoedd cynt cyn sefydlu'r cwrs fel cwrs cryno.

Er i drefn cwrs cryno gael ei chynllunio ar y cyntaf i hel at ei gilydd nifer cymharol fychan o fyfyrwyr o ardaloedd gwasgaredig, y mae i'r math hwn o gwrs fanteision addysgol o'i gyferbynnu â'r cwrs dydd, pan fo darpariaeth ar gyfer parhau gydag astudiaeth yn ystod y bwlch rhwng cyfnodau o waith yn y Coleg. Y mae rhai diwydianwyr yn gweld hyn, ac am hynny cychwynnwyd pum cwrs tebyg yn ychwanegol yn Llandaf ym mis Medi 1958 a hefyd un yng Ngholeg Technegol Casnewydd a Mynwy. Trefnir astudiaeth ddi-dor yn ystod y bwlch rhwng dau gyfnod o astudio amser-llawn yn y Coleg trwy ddilyn cwrs coleg technegol am un noson bob wythnos neu yntau trwy osod rhaglen waith i'r myfyrwyr ar gyfer adegau felly.

Y Meysydd Llafur

Y mae cyrsiau crefft colegau technegol yn arwain fel arfer i arholiadau tebyg i rai'r *City and Guilds* neu'r Dystysgrif Genedlaethol. Y mae'r Dystysgrif yn gofyn am gyraeddiadau academaidd uwch na'r *City and Guilds* ac y mae derbyn y Dystysgrif Genedlaethol Uwch yn codi'r prentis o safle crefftwr i safle technegwr neu efallai dechnolegwr. Dyma lwybr hunan-wellhad felly sydd yn rhoi pwys mawr ar y Dystysgrif Genedlaethol. Y mae llawer prentis yn cychwyn ar y llwybr hwn yn uchel ei obeithion ond heb fawr o sail i'w hyder. Mae llawer yn methu hyd yn oed yn arholiad y flwyddyn gyntaf (S.1). O'r rhai sydd yn llwyddiannus yn hwyr neu'n hwyrach yn S.1, dim ond cyfartaledd bychan sydd yn ennill y Dystysgrif Genedlaethol Gyffredinol.

Mae'r ffigurau yn amrywio yn ôl y pwnc ond dyma amcangyfrif bras a haelionus o ganlyniadau Cymru:

(a) llwyddiannus yn S.1 ar y cynnig cyntaf—40 y cant.

(b) rhai'n cychwyn gyda chwrs S.1 ac yn dilyn yr yrfa i'r pen a derbyn y Dystysgrif Genedlaethol Gyffredinol heb orfod ail ddilyn cwrs unrhyw flwyddyn oherwydd methiant—10 y cant o'r rhai a ddechreuodd gydag S.1.

(c) rhai'n cychwyn gyda chwrs S.1 ac yn dilyn yr yrfa i'r pen gan dderbyn y Dystysgrif Genedlaethol Uwch heb orfod ail ddilyn cwrs unrhyw flwyddyn oherwydd methiant—3 y cant o'r rhai a ddechreuodd gydag S.1.

Y mae'r tabl canlynol yn dangos gyrfa grwp o fyfyrwyr (o gyrsiau dydd rhanamser a chyrsiau nos) a gychwynnodd gyda blwyddyn gyntaf cwrs y Dystysgrif Genedlaethol mewn Peirianneg Fecanyddol a Thrydanol mewn coleg technegol yng Nghymru ym mis Medi 1950. Cred y Cyngor fod hwn yn fraslun teg o'r sefyllfa yn gyffredinol yng Nghymru.

1950-51				1951-52				1952-53				1953-54			
Yn eistedd yr arholiad		Ll.	M.	Ail Gynnig		Ll.	M.	Ail Gynnig		Ll.	M.	Ail Gynnig		Ll.	M.
S.1	147	66	81	S.2	57	27	30	S.3	27	9	18	A.1	6	5	1
				S.1	27	10	17	S.2	34	13	21	S.3	27	13	14
								S.1	4	1	3	S.2	11	3	8
												S.1	Nil	–	–

1954-55				1955-56				1956-57			
Ail Gynnig		Ll.	M.	Ail Gynnig		Ll.	M.	Ail Gynnig		Ll.	M.
A.2	5	2	3	A.2	8	6	2	A.2	1	1	0
A.1	10	4	6	A.1	4	1	3	A.1	2	0	2
S.3	11	5	6	S.3	2	2	0	S.3	Nil	–	–
S.2	4	1	3	S.2	Nil	–	–	S.2	Nil	–	–
S.1	Nil	–	–	S.1	Nil	–	–	S.1	Nil	–	–

O'r 147 a geisiodd ar S.1:

enillodd 2 (1·4 y cant) y Dystysgrif Genedlaethol Uwch (*H.N.C.*) heb ail ddilyn blwyddyn;

enillodd 9 (6·1 y cant) y Dystysgrif Genedlaethol Gyffredinol (*O.N.C.*) heb ail ddilyn blwyddyn;

enillodd 9 (6·1 y cant) y Dystysgrif Genedlaethol Uwch (*H.N.C.*) o'r diwedd;

enillodd 19 (12·9 y cant) y Dystysgrif Genedlaethol Gyffredinol (*O.N.C.*) o'r diwedd.

gadawodd 15 (10·2 y cant) y cwrs ar ôl ennill S.2;

gadawodd 33 (22·4 y cant) y cwrs ar ôl ennill S.1;

gadawodd 70 (47·6 y cant) heb ennill unrhyw gymhwyster dan drefn y Dystysgrif Genedlaethol.

Mae'n ddiau i rai a fu'n aflwyddiannus yng nghyrsiau'r flwyddyn gyntaf neu'r ail adael cyrsiau'r Dystysgrif er mwyn dilyn cyrsiau'r *City and Guilds*, ac iddynt bod yn llwyddiannus yn y cyrsiau hyn gan ennill cymwysterau crefft.

Y mae nifer y rhai aflwyddiannus yng nghyrsiau'r *City and Guilds* yn peri'r un pryder. Ond nid oes unrhyw gwrs haws i dderbyn y rhai sy'n methu yn y cyrsiau crefft.

Y mae'r mwyafrif mawr o arholiadau'r *City and Guilds* mewn pynciau crefft yn dilyn patrwm deublyg—arholiad canolradd ar ben tair blynedd yn y coleg ac arholiad terfynol ar ben pum mlynedd. Mewn rhai pynciau eisteddir yr arholiadau yma ar ben yr ail a'r bedwaredd flwyddyn. Cyflwynir Tystysgrifau Canolradd a Thystysgrifau Terfynol i'r rhai llwyddiannus. Cyflwynir 'Tystysgrifau Technoleg Llawn,' enw camarweiniol bellach, i fyfyrwyr yn y rhan fwyaf o bynciau os ydynt yn llwyddiannus yn arholiad terfynol eu pwnc a hefyd yn boddhau'r Sefydliad ynglyn â'u gwybodaeth am adrannau perthnasol gwyddoniaeth neu gelfyddyd, a'u profiad o ymarfer eu crefft, a'u bod wedi troi eu hun-ar-ugain oed.

Mewn llawer pwnc gofynnir am allu academaidd a weddai'n well i safon technegwr. Mae llu yn methu, hyd yn oed yn y safon Ganolradd, oblegid ansawdd academaidd yr arholiad. Mae'r *City and Guilds of London Institute* wedi cydnabod yn ddiweddar nad yw arholiadau rhai pynciau yn addas i brentisiaid crefft o gyraeddiadau academaidd mor amrywiol. Er enghraifft, mewn peirianneg fecanyddol cychwynnwyd arholiad newydd a elwir yn ymarfer crefft peirianneg fecanyddol fel ail ddewis yn lle yr arholiad arferol, sef arholiad peirianneg gweithdy. Rhoddir mwy o bwyslais ar waith ymarferol a llai ar allu academaidd yn yr arholiad newydd nag yn yr un arferol. Mae trefniant tebyg ar droed ar gyfer arholiadau crefft adeiladaeth.

Prentisiaid Heb Raddio

Derbyniad

Edrychir ar brentisiaid heb raddio fel un o ffynonellau technolegwyr neu dechnegwyr â champ arnynt. Mae telerau derbyn yn amrywio o un diwydiant i'r llall, o lwyddiant mewn Saesneg, mathemateg a gwyddoniaeth yn arholiad lefel Gyffredinol y Dystysgrif Addysg (*G.C.E.*) i lwyddiant mewn matbemateg, ffiseg a chemeg yn y lefel Uwch. Weithiau codir prentisiaid crefft i fod yn brentisiaid heb raddio os bydd eu gwaith yn arholiad y Dystysgrif Genedlaethol Gyffredinol yn ddigon da. Daw mwyafrif y prentisiaid heb raddio o ysgolion gramadeg pan fônt rhwng 16 a 18 oed.

Cododd eu nifer yn gyson yn niwydiannau Cymru yn ddiweddar. Dyma grynodeb o'r atebion a gafwyd i'r holiadur a ddanfonwyd yn enw'r Cyngor at ddiwydianwyr (Gweler atodiad M):—

Diwydiannau Preifat

Y Nifer y danfonwyd atynt	628			
Y Nifer a atebodd	350			
Y nifer o'r rhai a atebodd sy'n derbyn prentisiaid heb raddio	42			
		1955	1956	1957
(i) Nifer y lleoedd gwag i brentisiaid heb raddio		157	188	255
(ii) Y nifer a dderbyniwyd i'r safleoedd hyn ...		145	179	242
(iii) Amcangyfrif o'r derbyniad blynyddol yn ystod 1958-62	202			

Diwydiannau a Genedlaetholwyd

Y Nifer y danfonwyd atynt	10			
Y Nifer a atebodd	10			
Nifer y rhai sy'n derbyn prentisiaid heb raddio	6			
		1955	1956	1957
(i) Nifer y lleoedd gwag...		57	82	103
(ii) Nifer y lleoedd a lanwyd		49	65	74
(iii) Amcangyfrif o'r derbyniad blynyddol yn ystod 1958-62	79			

Dylid nodi mai yn 1957 y dechreuodd y Bwrdd Glo dderbyn brentisiaid heb raddio, a'r flwyddyn honno, derbyniodd y Bwrdd 32 er bod 44 o leoedd gwag. Felly yr oedd y naw diwydiant arall a genedlaetholwyd yn cynnig llai o leoedd gwag (59) yn 1957 nag yn 1956 (82). Yr un oedd hanes y nifer a dderbyniwyd, 42 yn 1957 a 60 yn 1956. Mae amcangyfrif pob diwydiant o'u gofynion yn ystod y cyfnod 1958-62, sef 281, yn llai nag yn 1957, sef 358. Efallai mai'r rheswm am ragolygon mor ddu fel ateb i'r holiadur oedd i'r Cyngor ei ddanfon allan yng nghanol argyfwng economaidd 1958.

Hyfforddiant a Chyrsiau

Y mae'r brentisiaeth yn estyn dros gyfnod sy'n amrywio o dair i bum mlynedd yn ôl cymwysterau academaidd y prentis a'r math o gwrs technegol a fydd yn rhan o'i brentisiaeth.

Gall prentis a fu'n llwyddiannus yn lefel Uwch y *G.C.E.* mewn pynsciau perthnasol ddilyn cwrs gradd prifysgol neu gwrs rhyngosod coleg technegol sy'n arwain i'r Ddiploma Genedlaethol Uwch neu i'r Ddiploma Dechnoleg. Bydd ei ddewis yn dibynnu ar ei gymwysterau ac ar bolisi addysgol ei feistr gwaith. Mae cwrs gradd yn gofyn rhyddhad o ddiwydiant am dair blynedd o leiaf. Mae cwrs rhyngosod ar gyfer Diploma yn gofyn rhyddhad am chwe mis bob blwyddyn dros gyfnod o dair i bum mlynedd.

Ar hyn o bryd, bydd prentis a fu'n llwyddiannus ar lefel Gyffredinol y *G.C.E.*, neu gwrs o safon tebyg, yn dilyn cwrs y Dystysgrif Genedlaethol ar drefn rhyddhad dydd. Dyna, o leiaf, yw'r ffasiwn arferol yn awr. Ond yn ôl ei gymwysterau y mae'n ddigon teilwng i fanteisio ar gyfleusterau a gynigir gan ychydig o'r colegau technegol i ddilyn cwrs dwy flynedd ar gyfer Diploma Genedlaethol Gyffredinol neu gwrs rhag-baratoawl ar gyfer Diploma, cwrs un blwyddyn neu ddwy. Cyrsiau rhyngosod a fyddai'r rhain. Byddai llwyddiant yn un ohonynt yn arwain i'r Ddiploma Genedlaethol Uwch neu efallai i'r Ddiploma Dechnoleg. Eto, fel y dywedwyd, cyrsiau'r Dystysgrif Genedlaethol sy'n denu'r mwyafrif ac iddynt hwy, o fod yn llwyddiannus, y mae o leiaf bedwar llwybr pellach:

(a) cwrs yn arwain i'r Dystysgrif Genedlaethol Uwch;

(b) gallant gael eu derbyn i rai prifysgolion, gan gynnwys Prifysgol Cymru, os bydd Saesneg ar lefel 'pasio' yn un o'u pynciau yn arholiad lefel Gyffredinol y *G.C.E.*, ac os byddant hefyd wedi cael profiad tair blynedd mewn diwydiant;

(c) gallant ddilyn cwrs Diploma Genedlaethol Uwch os cafwyd marc o 50 y cant neu fwy ym mhob papur yn arholiad y Dystysgrif Genedlaethol Uwch;

(d) gallant ddilyn cwrs Diploma Dechnoleg ar delerau (c) uchod, dim ond bod eisiau marc o 60 y cant neu fwy.

Nid ei gymwysterau a'i gyraeddiadau yn unig sy'n penderfynu pa gwrs a ddilynnir gan berson arbennig. Dibynna hyn hefyd ar bolisi ei feistr gwaith, ei bolisi ŷnglyn â hyfforddiant a chynnig rhyddhad i ddilyn cwrs. Dengys y ffigurau isod mai cyfran fechan o'r rhai a allai wneud hynny a barnu yn ôl safon eu Tystysgrif Genedlaethol Gyffredinol, sydd mewn gwirionedd yn dilyn cyrsiau gradd a diploma. Mae'r mwyafrif yn dal i ddilyn cwrs Uwch y Dystysgrif Genedlaethol, drwy waith undydd neu dair noson yr wythnos mewn coleg technegol.

Rhoddir cyfrif o gyrsiau sesiwn 1958-59 a ddilynwyd gan Gymry a feddai'r

Dystysgrif Genedlaethol Gyffredinol yn atodiad A. Sylwer ar y canlynol:

(i) Nifer a dderbyniodd Dystysgrifau Cenedlaethol Cyffredinol yn 1958	800
(ii) Nifer a gafodd farc gwell na 60 y cant yn yr arholiadau hyn	172
(iii) Nifer a gafodd farc rhwng 50 y cant a 60 y cant	244
(iv) Nifer a aeth i goleg prifysgol ym mis Medi 1958	10
(v) Nifer y rhai o (ii) a gychwynnodd ar gwrs Diploma Dechnoleg ym mis Medi 1958	3
(vi) Nifer y rhai o (ii) a (iii) a gychwynnodd ar gwrs Diploma Genedlaethol Uwch ym mis Medi 1958	17
(vii) Nifer y rhai o (ii) a ddilynodd gwrs Tystysgrif Genedlaethol Uwch yn 1958-59	122
(viii) Nifer y rhai o (iii) a ddilynodd gwrs Tystysgrif Genedlaethol Uwch yn 1958-59	193

Dylai'r ffigurau hyn beri pryder canys nid ydynt gyson â'r galw diddiwedd am gynnydd yn rhif technolegwyr y wlad. Sylwer yn arbennig ar y ffeithiau a ganlyn:

(a) o 172 cymwys i gychwyn ar gwrs Diploma Dechnoleg yn ôl eu Tystysgrif Genedlaethol Gyffredinol, dim ond 3, hyd y gellir gweld, a wnaeth hynny ym mis Medi 1958;

(b) yr oedd o leiaf 244 yng Nghymru yn gymwys yn ôl eu Tystysgrif Genedlaethol Gyffredinol, i ddechrau ar gwrs Diploma Genedlaethol Uwch. Dim ond 17 ohonynt a wnaeth hyn ym mis Medi 1958.

Dyma ffaith arall a ddylai ddyfnhau'r pryder. Derbyniodd diwydiannau Cymru 316 myfyriwr brentis newydd yn 1957 gyda llwyddiant digonol yn arholiadau'r Dystysgrif Addysg (*G.C.E.*). Ym mis Medi yn yr un flwyddyn, ychydig dros gant yn unig o'r rhain a gychwynnodd ar gyrsiau rhyngosod uwch yn arwain i'r Ddiploma Dechnoleg (14) neu'r Ddiploma Genedlaethol Uwch (91).

Fel arfer bydd prentisiaid sy'n dilyn cwrs uwch amser-llawn neu gwrs rhyngosod yn derbyn eu cyflog pan fônt yn y coleg. Os na fyddant yn ei dderbyn, gallant ofyn i'w hawdurdodau addysg lleol am grant i'w cadw, fel y sylwyd yma eisoes.

Yn y mwyafrif o gynlluniau gwaith prentisiaid heb raddio, dechreuir yr hyfforddiant ymarferol gyda chwrs yn egwyddorion sylfaenol y grefft er mwyn cynefino'r prentis â hwy. Fel arfer bydd hyn yn ymestyn dros flwyddyn gyntaf neu ddwy flynedd gyntaf y brentisiaeth. O hyn ymlaen, bydd natur yr hyfforddiant ymarferol yn dibynnu ar adnoddau'r diwydiant arbennig. Mewn un cynllun a ddangoswyd i'r Cyngor, dechreuwyd gydag ymarfer yn y swyddfa luniadu, yna mewn gwaith cynllunio a datblygu, yna mewn adran ariannol yn cyfrif cost, ac yn olaf, mewn adran i drefnu gorchwyl arbennig lle y byddai holl agweddau'r gwaith yn asio gyda'i gilydd. Mewn cynllun arall, bwriai'r prentis gyfnod ei hyfforddiant ymarferol bron yn llwyr yn y swyddfa luniadu.

Y mae'r asio naturiol hwn rhwng hyfforddiant ymarferol mewn diwydiant a chwrs addysg y coleg technegol yn un o brif rinweddau'r cynllun rhyngosod. Rhaid i ddiwydiant a choleg chwarae eu rhan briodol os yw'r prentis i gael y gorau o'i gwrs. Ni ellir edrych arnynt ar wahân.

Prentisiaid Graddedig

Bydd rhai cwmniau diwydiannol wrth dderbyn graddedigion yn syth o'r brifysgol heb fod ganddynt unrhyw brofiad diwydiannol, yn cynnig iddynt ddwy flynedd o hyfforddiant ychwanegol yn yr hyn sy'n bwrpasol i waith y diwydiant. Y pryd hwn, gelwir ef yn brentis graddedig. Y mae mwyafrif y cyrff proffesiynol yn gweld gwerth yn yr hyfforddiant hwn ac yn ei arddel drwy dderbyn y prentis graddedig yn aelod o'r corff ar ôl iddo fwrw ei brentisiaeth yn foddhaol a chael profiad mewn diwydiant ar ôl hynny.

Dyma grynodeb o'r atebion i holiadur y Cyngor ynglŷn â prentisiaid graddedig:

Diwydiannau Preifat

Derbynnir prentisiaid graddedig gan ... 14

	1955	1956	1957
Nifer y lleoedd gwag	20	35	52
Y nifer a dderbyniwyd	16	27	42

Amcangyfrif o ofyn cyfnod 1958-62 ... 39

Diwydiannau a Genedlaetholwyd

Derbynnir prentisiaid graddedig gan ... 2

	1955	1956	1957
Nifer y lleoedd gwag	11	11	11
Y nifer a dderbyniwyd	3	4	7

Amcangyfrif o ofyn y cyfnod 1958-62 ... 7

Mae gan y Bwrdd Glo gynllun a elwir yn gynllun Hyfforddiant Ymarfer o dan Gyfarwyddyd (Directed Practical Training). Ei bwrpas yw rhoi hyfforddiant trefnus i reolwyr ac uchel swyddogion y dyfodol Derbynnir graddedigion a hefyd rai a chanddynt gymwysterau o safon debyg mewn pynciau pwrpasol ac fe'u hyfforddir i fyny hyd at dair blynedd dan y cynllun hwn. Yn 1955, 56 a 57, yr oedd 60 o leoedd gwag gan adran orllewin y Bwrdd Glo, ac yn 1958, 47 ohonynt. Derbyniwyd i'w llenwi yn y pedair blynedd hyn 35, 58, 58 a 40.

Anaml iawn y rhyddheir prentisiaid graddedig i fynychu coleg technegol gan y tybir eu bod eisoes wedi gorffen eu hastudiaeth academaidd. Ond os dewisir rhai ohonynt ar gyfer gwaith gweinyddu a rheoli, gellir eu rhyddhau hwy i ddilyn cwrs mewn astudiaethau rheolaeth gwaith naill ai mewn coleg technegol neu yn y diwydiant ei hun.

PENNOD IV

Sylwadau Ac Argymhellion

Yn sicr y mae'r ddarpariaeth bresennol yng Nghymru ar gyfer addysg dechnegol yn fwy na digonol a barnu wrth ofynion diwydiant ac wrth nifer a gallu'r rhai sy'n ei derbyn. Bydd yn werth i ni ystyried yn nes ymlaen a oes llinyn mesur arall. Y mae'r awdurdodau addysg lleol wedi gwneud yn rhagorol trwy ddarparu lle a chynnig staff i ateb gofynion cynyddol diwydiant er 1945 am hyfforddiant i weithwyr o bob safon. Efallai yn wir iddynt wneud gormod weithiau fel bod y ddarpariaeth yn fwy na'r gofyn. Yn awr, gan fod y gofyn taer am ragor o le i addysgu wedi ei ateb i raddau helaeth, gobeithia'r Cyngor hwn y bydd i'r awdurdodau addysg lleol ganolbwyntio ar wella cyfleusterau myfyrwyr yn y colegau, lle mae eisiau gwella, a sylwi hefyd â diddordeb ar y ffaith fod capel coleg yng Ngholeg Technoleg Uwch Cymru.

Ar hyn a bryd, y mae gan holl gynllun addysg dechnegol gysylltiad agos iawn â gofynion uniongyrchol diwydiant. Os pery hyn, bydd newid yng ngofynion diwydiant yn rhwym o fagu newid yn y drefn addysgol. Mewn cyfnod o newid mor chwim mewn gwybodaeth dechnegol a'r ymarfer ohoni, amhosibl yw rhagweld gofynion newydd hyd yn oed dros ddeng mlynedd. Ond gellir dweud un peth, a'i ddweud yn groyw. Rhaid i gnewyllyn a sylwedd trefn addysg dechnegol fod yn ystwyth i ateb y newid. Nid gofynion diwydiant yn unig y mae'n rhaid eu hateb. Y mae grym yn y gosodiad nad llawforwyn diwydiant yw addysg dechnegol. Yn hytrach y mae addysg dechnegol yn hawlio braint a rhyddid cyfundrefn addysgol a saif ar ei thraed ei hun. Dylid arddel ei swyddogaeth fel cyfrwng datblygu gallu a ffrwythlondeb meddwl a grea berson byw, ystwyth ei gerddediad, gyda'r awydd i wynebu'r newydd a meistroli'r rhyfedd. Rhaid gwahaniaethu'n ofalus rhwng addysg dechnegol yn yr ystyr eang a chyfarwyddyd technegol yn yr ystyr gyfyng o ymarfer a datblygu medr a chrefft arbennig. Yn y cyntaf ceir cyfanrwydd nad yw'r ail ond rhan ohono yn unig. Tra bo'r ail yn gyfrwng gosod person ieuanc ar ben ei gwys, cwys ddigon esmwyth a rhwydd ei rhediad, y mae'r cyntaf yn malio am fwy na dilyn cwys arbennig, sef am gynhyrchu person ystwyth ei feddwl. Felly ni ddylid hyfforddi crefftwyr yn unig i feistroli crefftau arbennig. Rhaid ceisio gwneud mwy fel y byddant fedrus yn eu hamser i feistroli dulliau newydd a fydd yn dilyn techneg newydd. Felly dylai addysg prentis crefft fod yn llai arbenigol a chyfyng nag ydyw ar hyn o bryd; dylid talu mwy o sylw i egwyddorion sylfaenol a chefndir gwyddonol ei grefft arbennig a chrefftau tebyg. Dylai blwyddyn gyntaf cwrs gael ei gwario ar waith mwy cyffredinol, wedi ei ddethol yn dra gofalus, i feithrin y ddisgyblaeth nodweddiadol honno sy'n hogi a rhoi min ar feddwl.

Fel y gwelwn ni bethau, nid oes unrhyw anghysondeb rhwng angen presennol diwydiant am grefftwyr medrus ag angen cymdeithas am addysg a fo'n gyfrwng nid yn unig i greu crefftwyr medrus ond i greu personau a fydd yn byw bywyd llawn. Rhaid i rywbeth sydd mor agos ei perthynas â'r unigolyn â threfn ei addysg gael ei asio yn y lle cyntaf ag anghenion hanfodol y person fel dyn gyda'i gyfrifoldeb cymdeithasol, teuluol a dynol. Nid yw hynny'n golygu gweithiwr gwael; dylai cyfundrefn addysg ofalus gyfarfod â'r ddau angen. Hyd yn oed yn awr, fe sylweddolwyd hyn i raddau helaeth yn y cyrsiau rhyngosod uwch, lle mae pynciau technolegol y coleg a'r gwaith ymarferol mewn diwydiant wedi eu huno, a chyda'i gilydd yn ffurfio cwrs cyfan. Mae'n arferol dweud hefyd fod astudiaethau diwylliannol yn rhan hanfodol o'r cyrsiau hyn. Rhaid diffinio yr hyn a olygir —ansawdd meddwl ydyw a ddyry liw ac anadl einioes i waith y coleg a'r gweithdy. Oddi mewn i'r dechnoleg ei hunan y mae hau'r had—pensaernïaeth oddi mewn i dechnoleg adeiladu, hanes technoleg oddi mewn i beirianneg. Nid digon yw neilltuo rhai oriau yn yr wythnos ar gyfer pynciau diwylliannol, fel y gelwir hwy, canys ar wahân ac oddi allan i gyfanrwydd y cwrs yr arhosant. Anos yw gweithredu ar egwyddorion fel y rhain mewn cyrsiau rhyddhad dydd uwch a mewn cyrsiau crefft oherwydd prinder amser a hefyd am fod y cwlwm rhwng gwaith y coleg a'r gweithdy yn rhy llac.

Prentisiaid Crefft

Derbyniad

Bu raid i'r Cyngor estyn ei ymchwil dros gyfnod cymharol faith a sylwyd fod barn diwydianwyr am ansawdd y rhai a dderbyniwyd fel prentisiaid crefft yn amrywio'n fawr yn ystod y cyfnod hwn. Ddechrau 1956 yr oedd llawer o gwyno am safon addysg ac ansawdd personol llawer o'r ymgeiswyr am brentisiaeth a chwynwyd fod diwydianwyr yn gorfod derbyn rhai, anfoddhaol i lenwi'r bylchau. Ond yn 1957 a 1958 yr oedd pethau'n gwella a chan fod bellach fwy o ymgeiswyr, gallai'r diwydianwyr ddewis a dethol. Dengys atodiad M fod nifer yr ymgeiswyr am brentisiaeth crefft yn y sefydliadau a atebodd ein holiadur wedi codi o 4,559 yn 1955 i 5,505 yn 1947, h.y. yn ôl 21 y cant. O'r rhain derbyniwyd 1,684 yn 1955 a 1,878 yn 1957, cynnydd o 12 y cant. Y Bwrdd Glo oedd yn gyfrifol am 95 y cant o'r cynnydd. Er nad oes ffigurau am 1958 gennym, mae lle i gredu fod nifer yr ymgeiswyr eto wedi codi a nifer y rhai llwyddiannus wedi gostwng. Ffigurau'r Weinyddiaeth Lafur am nifer bechgyn yn cychwyn 'prentisiaeth i grefftau medrus' yng Nghymru yn 1957 a 1958 yw 2,894 a 2,706, ac am ferched 393 a 382. (Gweler Atodiadiau H, J, K, L). Gyda mwy o gryn dipyn yn gadael ysgol yn yr ychydig flynyddoedd nesaf hyn, yn ôl ystadegau geni y blynyddoedd a ddilynodd y rhyfel, bydd nifer yr ymgeiswyr am brentisiaid yn sicr o godi bob blwyddyn. Eto, er hyn, efallai nad mwy o leoedd gwag fydd i'w llanw yng Nghymru ond llai. (Gweler Atodiad M.)

Y mae holl drefn derbyn i brentisiaeth crefft, ac y mae hyn yn golygu holl drefn hyfforddiant yn y crefftau, yn llwyr yn nwylo'r gwahanol ddiwydiannau. Y maent hwy gan mwyaf yn derbyn yn ôl eu gofynion eu hunain o ddydd i ddydd yn hytrach na'u gwir ofynion dros gyfnod o amser neu ofynion y diwydiant yn gyfan neu ofynion cyffredinol y wlad am brentisiaid. Trwy hap a damwain yn unig y gall cyfundrefn fel hyn ateb angen y wlad am gronfa ddigonol o weithwyr medrus. Mae newid yn y dymheredd economaidd yn union yn peri newid yn y galw am brentisiaid. O ganlyniad, derbynnir prentisiaid yn ôl y galw am lafur medrus yr adeg y derbynnir hwy, yn hytrach na'r gofyn mewn pedair neu bum mlynedd pan fyddant yn barod at waith. Eithriad ymhlith meistri gwaith yw'r un a gymer olwg bell ymlaen ar ei ofynion llafur ac a drefna i dderbyn prentisiaid yn unol â hyn. Fel rheol, ymlhith y cyrff diwydiannol mawr y gwelir yr eithriadau hyn.

Mewn gwaith neu ffatri arbennig, y mae'r undebau llafur yn pennu ffigur arbennig fel uchafrif nifer y prentisiaid i'w cynnal ymhob crefft. Rhif yw hwn sydd yn gyfartaledd penodedig o nifer y gweithwyr profiadol a gyflogir yn y gwaith arbennig yn y grefft arbennig. Y mae'r rheol hon yn sicr yn rhwystr i waith a fynn ehangu'n gyflym. Canlyniad arall i'r drefn hon, fel y gweithredir hi yn awr, yw fod cyfanrif y prentisiaid mewn crefft arbennig dros yr holl wlad yn llawer llai na'r cyfartaledd penodedig o gyfanrif gweithwyr profiadol y grefft, o gyfrif dros yr holl wlad. Canys y mae llawer gwaith neu ffatri yn derbyn llai nag a ganiateir iddynt gan yr Undebau ond nid yw'n bosibl i unrhyw ffyrm dderbyn mwy. Felly byddai'n dda o beth pe gallai ffyrmiau sy'n ewyllysio derbyn mwy wneud hynny gyda'r amod na thorrir rheol cyfartaledd penodedig yr Undebau o gyfrif dros yr holl wlad.

Gallai Cynlluniau Grwp i brentisiaid yng Nghymru yn hawdd godi nifer prentisiaid crefft ac hefyd gynnig well safon hyfforddi nag a gynigir gan lawer ffyrm yn awr. Yn naturiol, llwm yw adnoddau hyfforddi llawer ffyrm fach ac am hynny ni dderbynnir prentisiaid crefft gan lawer ohonynt. Mae'n debyg y gwnaent pe bai Cynlluniau Grwp ar gael.

A barnu oddi wrth y dystiolaeth a roddwyd i'r Cyngor mewn sgwrs ac ar bapur, nid oes llawer o argoel am unrhyw godiad yn y nifer a dderbynnir i brentisiaeth crefft yng Nghymru yn y dyfodol agos. Felly prin fydd cyfraniad diwydiannau Cymru i nod y Llywodraeth o ychwanegu at nifer crefftwyr medrus Prydain yn y blynyddoedd nesaf hyn. Os yw angen hir-amser y wlad yn fwy nag amcangyfrif diwydiant ynglŷn â'u hangenion hwy rhaid digoni'r angeniannau naill ai trwy ddenu diwydianwyr i hyfforddi mwy nag a dybiant y bydd eu heisiau arnynt neu ynteu trwy gynnal cyfundrefn hyfforddi genedlaethol neu rywbeth tebyg. Byddai cynllun felly hefyd yn cynnig hyfforddiant gwell ac ehangach na llawer cynllun hyfforddi a geir ar hyn o bryd.

Y mae'n amheus a yw diwydianwyr yn talu sylw digonol i'r broblem o ddewis prentisiaid er mwyn sicrhau dewisiad da. Y mae rhai sefydliadau yn cymryd gofal mawr trwy astudio adroddiadau prifathrawon, nodiadau Swyddogion Cyflogi Ieuenctid, ac hefyd ddefnyddio ffordd safonol o ddethol a didoli. Ond yn rhy aml o lawer penderfynir ar bwys ffactorau eraill llai perthnasol. Yn sicr fe gytunai'r Cyngor hwn fod lle mawr i draddodiad teuluol mewn crefft er mwyn ennyn brwdfrydedd a balchder yn eu crefft ymhlith ieuenctid. Ond ar yr un pryd credwn na ddylid dewis trwy roi ffafr i blant gweithwyr y gwaith, nag i neb arall ar gymhelliad personol, os na fydd cymwysterau digonol o ran addysg ac ansawdd personol yn yr ymgeiswyr.

Hyfforddiant

Yn ôl rheolau'r undebau llafur, y mae prentisiaeth crefft yn awr yn estyn dros bum mlynedd yn ddieithriad, beth bynnag fo'r grefft, a rhaid i'r brentisiaeth orffen pan fo'r prentis yn 21 oed. Bu hyn, sef gorffen yn 21, yn rheol erioed, ond y mae hyd prentisiaeth wedi amrywio gydag oed gadael ysgol. Yn y ganrif ddiwethaf, yr oedd cyfnod hyfforddiant o saith mlynedd yn beth cyffredin, ond, fel y cododd oed gadael ysgol ddechrau'r ganrif hon, cododd hefyd oed dechrau prentisiaeth a gostyngodd ei hyd. Yn awr, 15½ i 16½ yw oed cychwyn prentisiaeth yn y rhan fwyaf o grefftau. Drwy ddal ymlaen yn yr ysgol, naill ai i astudio pwnc a fydd o fudd iddo yn ei alwedigaeth neu i sefyll arholiad y Dystysgrif Addysg Gyffredinol, y mae llawer bachgen wedi colli'r cyfle i'w brentisio i grefft am iddo fynd yn rhy hen. Hefyd, er mwyn derbyn prentisiaeth, mae llawer yn awr yn gadael ysgol yn rhy gynnar er eu lles eu hunain. Mae dal i lynu wrth yr hen reolau hyn yn milwrio yn erbyn barn llawer fod cyfnod llai o brentisiaeth yn ddigon mewn llawer crefft ac hefyd yn erbyn yr holl ymdrech i gadw plant yn yr ysgol cyhyd ag y bydd gwneud gwaith ysgol o les iddynt.

Ar fater hyfforddiant rhag-baratoawl i brentisiaid, sylwa'r Cyngor gyda diddordeb ar gychwyn cyrsiau un flwyddyn amser-llawn mewn colegau technegol. Yn ogystal â rhoi hyfforddiant trwyadl mewn egwyddorion techneg ac hefyd ei gychwyn ar ei grefft ddewisol, gall cyrsiau fel hyn roi i fachgen gyfle i ymgynefino â ffyrdd a dulliau coleg technegol. Pan ddaw'n ôl eto mewn blwyddyn fel myfyriwr rhyddhad dydd, bydd ei brofiad o waith coleg yn help mawr iddo. Gyda staff cymwys ac offer pwrpasol, gellid anelu at hyfforddiant rhag-baratoawl fel hyn mewn ysgolion uwchradd modern a byddai datblygu cyrsiau '15+' o fantais cyffredinol i'r ysgol hefyd. Lle na byddai galw digonol i gyfiawnhau hyn ymhob ysgol uwchradd fodern, y mae'r Cyngor o'r farn y dylid dewis rhai ysgolion arbennig i ateb yr alwad dros ardal benodedig drwyddi draw.

Y mae llawer i'w ddweud dros gynllun prentisiaeth sy'n cynnwys blwyddyn amser-llawn mewn coleg technegol (er enghraifft, cynllun y Bwrdd Glo i beirianwyr a thrydanwyr pwll), neu mewn Ysgol Hyfforddiant Gwaith (ynghyd â rhyddhad dydd i ddysgu egwyddorion y grefft mewn coleg technegol). Yn ei flwyddyn gyntaf caiff prentis hyfforddiant ymarferol eang a diogel a rydd iddo sylfaen i adeiladu arni feistrolaeth ar ei grefft ym mlynyddoedd dilynol ei brentisiaeth.

Er nad yw'r cwrs rhyddhad cryno eto ond yn ei fabandod, mae'r Cyngor yn ffyddiog ynglŷn â chymeradwyo'r modd y mae'n rhagori ar gwrs rhyddhad dydd i bob diwydiant lle gellir rhyddhau prentisiaid am gyfnodau o gymaint â mis ar y tro dair gwaith y flwyddyn. Y mae'n gobeithio y datblygant ymhellach yng Nghymru, oblegid, yn ogystal a rhagoriaethau addysgol, y maent yn arbennig o hwylus i brentisiaid sy'n rhy bell i ffwrdd i elwa ar gyrsiau rhyddhad dydd. Ond rhaid bod yn ofalus fod eu trefniant yn ateb galluoedd academaidd prentisiaid crefft a gweithyddion. Y mae mis o amser-llawn yn rhoi mwy o gyfle i astudio cyson ond byddai rhoi gormod o sylw i theori, drwy gyfrwng darlithiau, heb lefain digonol o waith ymarferol mewn labordy yn debyg o beri 'diffyg traul academaidd' mewn cyfnod o astudio clos fel hyn.

Nid oes cysondeb ynglŷn â thâl prentis pan fo mewn coleg gan fod newid mawr yn hyn o beth rhwng arfer y naill ddiwydiant a'r llall. Caiff prentisiaid rhai diwydiannau ryddhad hyd un-ar-hugain oed ac weithiau yn hwy, eraill hyd ddeunaw oed ac y mae rhai diwydiannau'n gwrthod rhyddhad o gwbl, gyda chyflog neu hebddo. Mae'r Cyngor yn annog diwydianwyr i unioni'r anghysondeb yma drwy gynnig rhyddhad gyda chyflog i brentisiaid drwy holl gyfnod eu prentisiaeth, cyhyd ag y dilynant eu cyrsiau'n foddhaol.

Y Meysydd Llafur

Gellir rhannu cyrsiau prentisiaid crefft mewn colegau technegol yn fras i ddau gategori—cyrsiau'r Dystysgrif Genedlaethol a chyrsiau crefft ar gyfer arholiadau'r *City and Guilds of London Institute.* Fel y sylwyd eisoes, y mae cymwysterau'r Dystysgrif Genedlaethol yn uchel eu parch mewn diwydiant. Am hynny, gan eu bod yn allwedd i wellhad personol, y mae llawer prentis yn ceisio dilyn cyrsiau'r Dystysgrif Genedlaethol er na pherthyn iddo'r gallu academaidd na'r dyfalbarhad i ateb gofynion y Dystysgrif. Y mae llawer yn diffygio ym mlwyddyn gyntaf neu ail flwyddyn y cwrs mewn siomiant a diflastod. Bydd llawer o'r rhai siomedig wedyn yn croesi i gwrs y *City and Guilds.* Hen arfer wael iawn yw hon ym marn y Cyngor. Rhaid wrth wastraff a siom am ddwy flynedd er mwyn argyhoeddi'r prentisiaid eu hunain ac efallai eu meistri a'u hathrawon nad yw eu gallu'n ddigonol ac mai cyrsiau crefft sydd addas iddynt.

Y mae ffigurau'r gwastraff hwn yn ddigon i beri pryder. (Rhoddwyd enghraifft eisoes ar dudalen 101). Nid yw'n broblem arbennig Gymreig gan fod ffigurau tebyg dros Brydain ben baladr. Credwn fod mwy nag un rheswm dros y gwastraff a dyma rai.

(a) sylw annigonol i allu academaidd myfyriwr cyn ei dderbyn i mewn i flwyddyn gyntaf y cwrs. Gan fod cwrs Tystysgrif Genedlaethol yn gofyn cryn dipyn o allu academaidd, barna'r Cyngor y dylid newid cymwysterau derbyn a rhoi yn eu lle rai sy'n nodi'n decach wir allu academaidd y myfyriwr. Felly awgryma'r Cyngor roi terfyn ar dderbyn ar sail Tystysgrif Genedlaethol Ragbaratoawl ac hefyd cwrs blwyddyn gyntaf (S.1). Dylid yn hytrach dderbyn i mewn i gwrs Tystysgrif Genedlaethol ar lefel cwrs presennol yr ail flwyddyn sef S.2. Byddai'r cwrs wedyn yn gwrs dwy flynedd i lefel Tystysgrif Genedlaethol Gyffredinol a dwy flynedd ymhellach i'r lefel Uwch. Yn fwy na hyn, awgrymir y dylid mynnu llwyddiant lefel pasio mewn pedwar pwnc pwrpasol yn Arholiad Gyffredinol y *G.C.E.*, a hynny ar y cynnig cyntaf neu'r ail, fel amod lleiaf derbyniad. Ym marn y Cyngor byddai cymhwyster o'r safon weddol uchel hon a gydnabyddir drwy'r wlad yn gyfan ac a ddilynai waith mewn ysgol neu goleg technegol yn well prawf diagnosdig na'r arholiad S.1. bresennol. Hefyd, os methiant fyddai rhan y myfyriwr yn ei yrfa bellach tuag at Dystysgrif Genedlaethol, byddai cymhwyster G.C.E. yn fwy gwerthfawr iddo na llwyddiant yn S.1., pe dymunai symud i feysydd eraill. Dylid dal at y drefn bresennol o groesi o gyrsiau crefft i gyrsiau Tystysgrif Genedlaethol ar lefelau priodol;

(b) prinder athrawon gyda chymwysterau addas. Gan fod diwydiant wedi llyncu cymaint o wyddonwyr a thechnolegwyr er y rhyfel, y mae'r colegau technegol wedi dioddef gan brinder athrawon teilwng. Ar hyn o bryd, er bod gan athrawon colegau technegol gymwysterau academaidd yn y pynciau a ddysgant yno, nid yw llawer ohonynt wedi derbyn hyfforddiant o gwbl mewn dulliau dysgu. Un o argymhellion y Pwyllgor ar Hyfforddiant a Chyflenwad Athrawon Colegau Technegol, a gyhoeddwyd ym Mai 1957, oedd y dylid cynnal mwy o gyrsiau byrion a chyrsiau rhan-amser gan awdurdodau addysg lleol a Chynghorau Rhanbarthol Ymgynghorol ar Addysg Bellach. Rhoddai'r rhain gyfle i athrawon colegau technegol, lle byddai gofyn, dderbyn hyfforddiant mewn egwyddorion dysgu ac yn arbennig ddysgu pynciau technegol. Yng Nghymru yn 1958-59, cynhaliwyd dau gwrs o'r fath. Cwrs preswyl o wythnos oedd un ar ddysgu mathemateg mewn colegau technegol; cynhaliwyd ef dan nawdd y Cyd-bwyllgor Addysg Cymreig. Cwrs rhan-amser ar egwyddorion cyffredinol dysgu oedd y llall. Fe'i cynhaliwyd yng Ngholeg Technegol Wrecsam a threfnwyd ef gan adran addysg Coleg y Gogledd, Bangor. Yn haf 1957, trefnodd pwyllgor addysg Sir Fflint, gyda chydweithrediad Coleg Hyfforddi Athrawon yn Bolton, gwrs wythnos ar egwyddorion cyffredinol a dulliau arbennig dysgu technegol yng Ngholeg Technegol Sir Fflint. Fel rhan o raglen eu Hysgol Haf flynyddol i athrawon, bydd awdurdod addysg Sir Gaerfyrddin yn cynnig cwrs ar ddulliau dysgu pynciau technegol, ar gyfer athrawon colegau technegol. Ym Medi 1953, cychwynnwyd cyrsiau rhan-amser yng Ngholeg Technegol a Masnachol Caerdydd, bellach Coleg Technoleg Uwch Cymru, baratoi ar gyfer Tystysgrif Athro Technegol y *City and Guilds*. Tystysgrif yw hon ar gyfer athrawon rhan-amser mewn sefydliadau addysg bellach neu rai a'u bryd ar waith dysgu rhan-amser o'r fath. Mae'n agored hefyd i athrawon amser-llawn mewn ysbytai, diwydiant, sefydliadau addysg dechnegol, etc.—athrawon sydd heb dderbyn hyfforddiant mewn addysgu fel y cyfryw. Cynigir dau gwrs rhan-amser, un a gynhelir ar un prynhawn ac un noson bob wythnos am flwyddyn, ac un arall a gynhelir ar un noson bob wythnos am ddwy flynedd. Deallir mai nifer siomedig o isel sydd wedi ymateb trwy ddilyn y cyrsiau hyn. Os arwydd o hunanfodlonrwydd yn y colegau technegol yw hyn, yn sicr rhaid ei ddileu.

Tra noda'r Cyngor y ceisiadau hyn gyda pharch y mae'n barnu nad ydynt yn ddigonol o bell ffordd i ateb gofynion y dydd. Felly mae'n annog awdurdodau addysg lleol, cyrff llywodraethol colegau technegol a'u prifathrawon hefyd i roi pob gewyn ar waith i gynnal cyrsiau ac i roi rhwydd hynt i athrawon rhan-amser ac amser-llawn i'w dilyn trwy gynnig rhyddhad a help ariannol yn ôl y gofyn. Deallwn fod y Cyd-hwyllgor Addysg Cymreig wedi cychwyn ar gynllun i gynnal cyrsiau yn nhymor yr haf yng Ngholeg Technolegol Uwch Cymru er mwyn athrawon sydd eisoes yn dysgu mewn colegau technegol. Gobeithiwn y rhoddir i'r cais hwn gefnogaeth lwyr awdurdodau addysg lleol ac y caiff poh athro yn y colegau, heb dderbyn hyfforddiant mewn dysgu, gynnig mynd yno;

(c) cydweithrediad annigonol rhwng diwydiant a'r colegau technegol. Rhaid wrth y cydweithrediad hwn i ddiogelu buddiannau gorau'r myfyrwyr. Dylai diwydiant a choleg ofalu am sicrhau fod pob myfyriwr yn dilyn y cwrs mwyaf addas iddo. Mae lle i gredu fod rhai ffyrmiau'n disgwyl i'w prentisiaid ddilyn cwrs Tystysgrif Genedlaethol lle byddai cwrs *City and Guilds* yn fwy buddiol. Efallai mai rhyw rodres sydd wrth wraidd hyn neu efallai ddiffyg gwybodaeth am safon y cwrs ac am fodolaeth cwrs arall mwy pwrpasol. Beth bynnag fo'r gwir reswm amdano, dyma fater sy'n gofyn am sylw gofalus yn fuan. Gall camgynghori esgor ar ganlyniadau difrifol i'r prentis. Y mae'n gyfrifoldeb arbennig ar Swyddogion Addysg ac Hyfforddiant cwmnïau diwydiannol i gydweithio gyda phrifathrawon colegau technegol i warchod gwir fuddiannau'r myfyrwyr;

(ch) diogi a diffyg dyfal-barhad rhai myfyrwyr. Mae llawer ohonynt yn dilyn cyrsiau, heb unrhyw wir awydd i wneud hynny, ar orchymyn eu meistri yn unig. Gan nad yw methiant yn y cwrs yn lleihau eu siawns i fwrw prentisiaeth yn llwyddiannus, ac nad yw llwyddiant yn gwarantu dyrchafiad personol neu godiad ariannol, ni wêl prentis sydd heb lawer o uchelgais, bwrpas mewn dal ati. Byddai cadw llygad arnynt gan rieni, swyddogion gwaith a swyddogion coleg yn gymorth mawr i symud y difaterwch sydd mor nodweddiadol o agwedd rhai prentisiaid at eu cyrsiau;

(d) ansawdd wasgarog a thoredig yr hyfforddiant, sydd ynghlwm o reidrwydd wrth gyrsiau rhyddhad-dydd. Y mae wythnos rhwng pob gwers ac y mae hyn yn rhwystr arbennig i fyfyrwyr gwan. Ni fedr gydio mewn pwynt; rhaid gwario llawer gormod o amser ar ddechrau gwers i ail-adrodd yr hyn a ddywedwyd eisoes. Yn y fan yma y gwelir rhagoriaeth rhyddhad cryno yn amlwg; y mae cyfle i astudio yn ddi-fwlch mewn cwrs felly ac hefyd gyfle i ymhêl â phynciau ar wahân i'r rhai sy'n angenrheidiol ar gyfer yr arholiad. Er mai newydd yw'r cyrsiau yma, y mae'n harod le i gredu fod eu canlyniadau mewn arholiad yn rhagori ar rai cwrs rhyddhad-dydd. Dyma ffigurau o Goleg Technegol Llandaf yn 1958-59:

Pwnc	Llwyddiant mewn Arholiadau	
	Cwrs Cryno	Cwrs Rhyddhad-dydd
Peirianneg Fecanyddol (*O.N.C.*)	83 y cant	76 y cant
Peirianneg Gweithdy Peiriant (Canolradd)	62 y cant	30 y cant
Gosod Offer Trydan—Cwrs C	88 y cant	65 y cant

(vi) cyfle tecach i blant ardaloedd gwledig, gan roi iddynt gystal cyfle i dderbyn prentisiaeth â phlant tref a dinas yn yr ardaloedd diwydiannol.

Gŵyr y Cyngor yn dda nad hawdd fyddai newid y drefn bresennol a rhoi trefn genedlaethol yn ei lle, a chodai llawer problem anodd ynglŷn â gweinyddu trefn felly. Un broblem ganolog fyddai dod o hyd i nifer digonol o athrawon gyda'r cymwysterau angenrheidiol. Y cam pwysig cyntaf i ddatrys y broblem hon fyddai sefydlu cwrs i athrawon, a'u bryd ar waith fel hyn, yn un o golegau hyfforddi Cymru. Gŵyr y Cyngor hefyd na fyddai gobaith am lwyddiant heb gymorth parod y Llywodraeth, diwydiant a'r undebau llafur. Ond er yr holl anawsterau, y mae'r Cyngor yn bendant o'r farn fod yn rhaid wrth y newid hwn. Yn hyn o beth nid yw'r Cyngor yn cydfynd â chasgliadau adroddiad Carr *Training for Skill** ac adroddiad y Cyngor Canol ar Addysg Lloegr 15 *to* 18.†

Rhaid edrych ar bolisi fel hwn fel polisi dros hir amser gan nad oes modd sefydlu canolfannau hyfforddi ar amrantiad (hyn ymhlith pethau eraill). Yn y cyfamser, ac fel ail ddewis os gwrthodir trefn genedlaethol, mae'r Cyngor yn argymell gostwng hyd prentisiaeth crefft o'r pum mlynedd presennol i dair blynedd gan gymryd yn ganiataol y byddai'r prentisiaid a dderbynnid gan ddiwydiant rhwng 17 ac 18 oed wedi derbyn dwy flynedd o addysg amser llawn yn y pynciau sy'n sylfaenol ar gyfer addysg dechnegol. Cwrs arbennig dwy flynedd fyddai hwn mewn sefydliadau addysg addas, o ran staff ac o ran darpariaeth gyffredinol. Gallai fod mewn ysgol wedi ei dewis i wasanaethu ardal neu mewn coleg addysg bellach yn ôl amgylchiadau lleol. Dechreuai ar gyfer rhai rhwng 15 a 16 oed gan barhau hyd at arholiad arbennig i rai rhwng 17 ac 18 oed. Arholiad allanol fyddai orau, yng Nghymru o dan nawdd y Cyd-bwyllgor Addysg Cymreig. Byddai diwydianwyr yn gweld ymgeiswyr am brentisiaeth ddiwydiannol yn nhymor olaf y cwrs ac yn eu dewis yn derfynol ar ôl cwpláu'r cwrs.

Pynciau sylfaenol cwrs amser-llawn felly fyddai'r rhai arferol ym mhob rhan o ddiwydiant ymron, sef Saesneg, mathematig, ffiseg, cemeg, lluniadu peirianegol ynghyd â chwrs helaeth mewn ymarfer gweithdy a thechnoleg. Byddai pob maes llafur yn arddel gofynion cyffredinol diwydiant a byddai'n pwysleisio cymhwyso ymarferol. Mewn rhai ardaloedd gellid caniatáu gogwydd at ddiwydiant arbennig a hynny er mantais pe gwneid hyn heb newid ansawdd a safon yr hyfforddiant. Hefyd, dylid ymwneud â phynciau eraill a fyddai o werth diwylliannol i ddinasyddion y dyfodol.

Gŵyr y Cyngor na fyddai pawb ar ôl dilyn y cwrs yn derbyn prentisiaeth ond ychydig fyddai'r rhain, gobeithio, a dylai diwydiant fod yn barod i gydweithredu drwy dderbyn pawb a fyddai yn llwyddiannus i swydd bwrpasol os nad i brentisiaeth. Fodd bynnag, ni allai'r safon uwch o hyfforddiant addysgol a gyflwynid i gymaint fwy o brentisiaid lai na dylanwadu'n llesol ar gymdeithas. Byddai trefnusrwydd newydd mewn addysg dechnegol. Byddai'n achub llawer o blant ysgol rhag y benbleth anodd o orfod dewis, pan fyddant rhwng pymtheg ag un-ar-bymtheg oed, rhwng derbyn prentisiaeth a rhoi'r gorau i arholiad y *G.C.E.* ar y naill law ag aros yn yr ysgol i eistedd yr arholiad a cholli prentisiaeth oherwydd eu hoed ar y llaw arall. Canys er mai ar gyfer arholiad prentisiaeth y bwriedid y cwrs, gallai plant a ddilynai'r cwrs hwn eto eistedd arholaid y *G.C.E.* yn ôl eu dewis ar yr adeg briodol.

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* para. 18 'dylai'r cyfrifoldeb am hyfforddiant diwydiannol prentisiaid orwedd yn bendant ar ysgwyddau diwydiant.' Gwasg ei Mawrhydi, 195.

† *Loc. cit.*

Cyrsiau Uwch

Darpariaeth Ychwanegol mewn Colegau Technegol

Cyflwynodd y Llywodraeth raglen datblygu colegau technegol y wlad ym Mhapur Gwyn 1956 ar Addysg Dechnegol. Ymhlith pethau eraill, dyrchafwyd nifer o golegau i fod yn golegau technoleg uwch a gosodwyd nod newydd, sef codi nifer disgyblion cyrsiau uwch colegau technolegol o 9,500 i 15,000. Pwysleisiodd y Papur Gwyn yn arbennig werth cyrsiau rhyngosod. Gofynnodd i ddiwydianwyr ac awdurdodau lleol roi pob cymorth i fyfyrwyr gyda'r gallu i ddilyn cwrs uwch, yn arbennig cwrs amser-llawn neu gwrs rhyngosod.

Ymateb Siomedig Cymru i Gyrsiau Rhyngosod Uwch

Siomedig iawn hyd yma fu'r ymateb yng Nghymru i'r apel. Y mae cyrsiau mewn Peirianneg Fecanyddol ac mewn Peirianneg Drydanol, wedi eu cymeradwyo eisoes ar gyfer Diploma mewn Technoleg yng Ngholeg Technoleg Uwch Cymru. Hyd yn hyn ychydig a'u dilynodd (gweler tudalen 104). Er i'r Coleg gael hawl i gynnal cyrsiau mewn Ffiseg Gymhwysol ym Medi 1958, ni bu digon o ofyn hyd yn awr (Ionawr 1960) i roi cychwyn arnynt. Isel hefyd fu'r nifer a gofrestrwyd i Gyrsiau'r Ddiploma Genedlaethol Uwch yn y Coleg hwn ac yng ngholegau technegol eraill Cymru. O'r rhai a dderbyniodd Dystysgrif Genedlaethol Gyffredinol yn 1958 ac a feddai felly'r cymwysterau, ymunodd llai na 2 y cant â chwrs Diploma Dechnoleg ym Medi 1958. Byddai 7 y cant yn amcangyfrif hael, fel ffigur cyfatebol o'r nifer a ymunodd â chwrs Diploma Genedlaethol Uwch. Anodd deall ffigurau fel hyn yn y sefyllfa bresennol. Ar un llaw y mae gofyn taer drwy'r wlad am wyddonwyr a thechnolegwyr cymwys ac y mae'r cyfleusterau hyfforddi yn bod mewn colegau technegol arbennig. Ar y llaw arall, o'r rhai a enillodd Dystysgrif Genedlaethol Gyffredinol mewn cyrsiau rhyddhad dydd ac a ddangosodd drwy hyn y gallent elwa ar gyrsiau rhyngosod ar gyfer ennill cymwysterau uwch, ychydig sy'n dilyn y cyrsiau hyn. Parhânt, y mwyafrif mawr ohonynt, gyda chyrsiau rhyddhad dydd ar gyfer y Dystysgrif Genedlaethol Uwch. Yn sicr, gall y llwybr yma arwain at statws technolegwr ond rhaid sylwi ar eisiau'r Papur Gwyn ar Addysg Dechnegol: 'fel y datblyga technolegau yn fwyfwy cymhleth gan beri bod yn rhaid i'r technolegwr yntau fod yn fwy amryddawn, bydd straen ceisio cyrraedd safon uchel trwy astudio min nos neu ddiwrnod neu ddau'r wythnos, yn mynd yn llymach'. Mae'r Cyngor o'r farn mai cwrs rhyngosod uwch diploma yw'r llwybr priodol i statws technolegwr, ar wahân i gwrs gradd prifysgol, a dylid cydnabod hyn yn gyffredinol. Yn yr un modd, dylid cydnabod y Dystysgrif Genedlaethol Uwch fel cymhwyster priodol i dechnegwr o radd uchel. Llwybr i'r lleiafrif ac nid i'r mwyafrif fel yn awr, i gyrraedd statws technolegwyr y dylai'r Dystysgrif Genedlaethol fod. I leiafrif o rai cymwys wedi ennil Tystysgrif Genedlaethol Gyffredinol dylai ddal yn llwybr ar yr amod fod y lleiafrif hyn yn cael eu rhyddhau o'u gwaith am yspeidiau mwy sylweddol i ddilyn y cwrs.

I raddau helaeth iawn, y mae'r allwedd i broblem darparu ar gyfer gofynion diwydiant am ddynion a chanddynt gymwysterau uchel yn nwylo'r diwydianwyr eu hunain. Y mae darpariaeth hyfforddi eisoes yn bod. Ond er fod diwydianwyr yn gyffredinol yn barod i ganiatáu rhyddhad dydd, ni chynigir yn gyffredinol gyfle i ddilyn cyrsiau rhyngosod uwch. Mae'r Cyngor yn mawr obeithio mai rhywbeth dros dro yw'r diffyg hwn. Rhaid cofio mai newydd-ddyfodiaid yw'r cyrsiau rhyngosod. Dylai diwydianwyr, prifathrawon colegau technegol ac awdurdodau addysg lleol wneud eu gorau glas i roi pob cyfle i rai cymwys i'w dilyn.

(vi) cyfle tecach i blant ardaloedd gwledig, gan roi iddynt gystal cyfle i dderbyn prentisiaeth â phlant tref a dinas yn yr ardaloedd diwydiannol.

Gŵyr y Cyngor yn dda nad hawdd fyddai newid y drefn bresennol a rhoi trefn genedlaethol yn ei lle, a chodai llawer problem anodd ynglŷn â gweinyddu trefn felly. Un broblem ganolog fyddai dod o hyd i nifer digonol o athrawon gyda'r cymwysterau angenrheidiol. Y cam pwysig cyntaf i ddatrys y broblem hon fyddai sefydlu cwrs i athrawon, a'u bryd ar waith fel hyn, yn un o golegau hyfforddi Cymru. Gŵyr y Cyngor hefyd na fyddai gobaith am lwyddiant heb gymorth parod y Llywodraeth, diwydiant a'r undebau llafur. Ond er yr holl anawsterau, y mae'r Cyngor yn bendant o'r farn fod yn rhaid wrth y newid hwn. Yn hyn o beth nid yw'r Cyngor yn cydfynd â chasgliadau adroddiad Carr *Training for Skill** ac adroddiad y Cyngor Canol ar Addysg Lloegr 15 *to* 18.†

Rhaid edrych ar bolisi fel hwn fel polisi dros hir amser gan nad oes modd sefydlu canolfannau hyfforddi ar amrantiad (hyn ymhlith pethau eraill). Yn y cyfamser, ac fel ail ddewis os gwrthodir trefn genedlaethol, mae'r Cyngor yn argymell gostwng hyd prentisiaeth crefft o'r pum mlynedd presennol i dair blynedd gan gymryd yn ganiataol y byddai'r prentisiaid a dderbynnid gan ddiwydiant rhwng 17 ac 18 oed wedi derbyn dwy flynedd o addysg amser llawn yn y pynciau sy'n sylfaenol ar gyfer addysg dechnegol. Cwrs arbennig dwy flynedd fyddai hwn mewn sefydliadau addysg addas, o ran staff ac o ran darpariaeth gyffredinol. Gallai fod mewn ysgol wedi ei dewis i wasanaethu ardal neu mewn coleg addysg bellach yn ôl amgylchiadau lleol. Dechreuai ar gyfer rhai rhwng 15 a 16 oed gan barhau hyd at arholiad arbennig i rai rhwng 17 ac 18 oed. Arholiad allanol fyddai orau, yng Nghymru o dan nawdd y Cyd-bwyllgor Addysg Cymreig. Byddai diwydianwyr yn gweld ymgeiswyr am brentisiaeth ddiwydiannol yn nhymor olaf y cwrs ac yn eu dewis yn derfynol ar ôl cwpláu'r cwrs.

Pynciau sylfaenol cwrs amser-llawn felly fyddai'r rhai arferol ym mhob rhan o ddiwydiant ymron, sef Saesneg, mathematig, ffiseg, cemeg, lluniadu peirianegol ynghyd â chwrs helaeth mewn ymarfer gweithdy a thechnoleg. Byddai pob maes llafur yn arddel gofynion cyffredinol diwydiant a byddai'n pwysleisio cymhwyso ymarferol. Mewn rhai ardaloedd gellid caniatáu gogwydd at ddiwydiant arbennig a hynny er mantais pe gwneid hyn heb newid ansawdd a safon yr hyfforddiant. Hefyd, dylid ymwneud â phynciau eraill a fyddai o werth diwylliannol i ddinasyddion y dyfodol.

Gŵyr y Cyngor na fyddai pawb ar ôl dilyn y cwrs yn derbyn prentisiaeth ond ychydig fyddai'r rhain, gobeithio, a dylai diwydiant fod yn barod i gydweithredu drwy dderbyn pawb a fyddai yn llwyddiannus i swydd bwrpasol os nad i brentisiaeth. Fodd bynnag, ni allai'r safon uwch o hyfforddiant addysgol a gyflwynid i gymaint fwy o brentisiaid lai na dylanwadu'n llesol ar gymdeithas. Byddai trefnusrwydd newydd mewn addysg dechnegol. Byddai'n achub llawer o blant ysgol rhag y benbleth anodd o orfod dewis, pan fyddant rhwng pymtheg ag un-ar-bymtheg oed, rhwng derbyn prentisiaeth a rhoi'r gorau i arholiad y *G.C.E.* ar y naill law ac aros yn yr ysgol i eistedd yr arholiad a cholli prentisiaeth oherwydd eu hoed ar y llaw arall. Canys er mai ar gyfer arholiad prentisiaeth y bwriedid y cwrs, gallai plant a ddilynai'r cwrs hwn eto eistedd arholaid y *G.C.E.* yn ôl eu dewis ar yr adeg briodol.

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* para. 18 'dylai'r cyfrifoldeb am hyfforddiant diwydiannol prentisiaid orwedd yn bendant ar ysgwyddau diwydiant.' Gwasg ei Mawrhydi, 195.

† *Loc. cit.*

Cyrsiau Uwch

Darpariaeth Ychwanegol mewn Colegau Technegol

Cyflwynodd y Llywodraeth raglen datblygu colegau technegol y wlad ym Mhapur Gwyn 1956 ar Addysg Dechnegol. Ymhlith pethau eraill, dyrchafwyd nifer o golegau i fod yn golegau technoleg uwch a gosodwyd nod newydd, sef codi nifer disgyblion cyrsiau uwch colegau technolegol o 9,500 i 15,000. Pwysleisiodd y Papur Gwyn yn arbennig werth cyrsiau rhyngosod. Gofynnodd i ddiwydianwyr ac awdurdodau lleol roi pob cymorth i fyfyrwyr gyda'r gallu i ddilyn cwrs uwch, yn arbennig cwrs amser-llawn neu gwrs rhyngosod.

Ymateb Siomedig Cymru i Gyrsiau Rhyngosod Uwch

Siomedig iawn hyd yma fu'r ymateb yng Nghymru i'r apel. Y mae cyrsiau mewn Peirianneg Fecanyddol ac mewn Peirianneg Drydanol, wedi eu cymeradwyo eisoes ar gyfer Diploma mewn Technoleg yng Ngholeg Technoleg Uwch Cymru. Hyd yn hyn ychydig a'u dilynodd (gweler tudalen 104). Er i'r Coleg gael hawl i gynnal cyrsiau mewn Ffiseg Gymhwysol ym Medi 1958, ni bu digon o ofyn hyd yn awr (Ionawr 1960) i roi cychwyn arnynt. Isel hefyd fu'r nifer a gofrestrwyd i Gyrsiau'r Ddiploma Genedlaethol Uwch yn y Coleg hwn ac yng ngholegau technegol eraill Cymru. O'r rhai a dderbyniodd Dystysgrif Genedlaethol Gyffredinol yn 1958 ac a feddai felly'r cymwysterau, ymunodd llai na 2 y cant â chwrs Diploma Dechnoleg ym Medi 1958. Byddai 7 y cant yn amcangyfrif hael, fel ffigur cyfatebol o'r nifer a ymunodd â chwrs Diploma Genedlaethol Uwch. Anodd deall ffigurau fel hyn yn y sefyllfa bresennol. Ar un llaw y mae gofyn taer drwy'r wlad am wyddonwyr a thechnolegwyr cymwys ac y mae'r cyfleusterau hyfforddi yn bod mewn colegau technegol arbennig. Ar y llaw arall, o'r rhai a enillodd Dystysgrif Genedlaethol Gyffredinol mewn cyrsiau rhyddhad dydd ac a ddangosodd drwy hyn y gallent elwa ar gyrsiau rhyngosod ar gyfer ennill cymwysterau uwch, ychydig sy'n dilyn y cyrsiau hyn. Parhânt, y mwyafrif mawr ohonynt, gyda chyrsiau rhyddhad dydd ar gyfer y Dystysgrif Genedlaethol Uwch. Yn sicr, gall y llwybr yma arwain at statws technolegwr ond rhaid sylwi ar eisiau'r Papur Gywn ar Addysg Dechnegol: 'fel y datblyga technolegau yn fwyfwy cymhleth gan beri bod yn rhaid i'r technolegwr yntau fod yn fwy amryddawn, bydd straen ceisio cyrraedd safon uchel trwy astudio min nos neu ddiwrnod neu ddau'r wythnos, yn mynd yn llymach'. Mae'r Cyngor o'r farn mai cwrs rhyngosod uwch diploma yw'r llwybr priodol i statws technolegwr, ar wahân i gwrs gradd prifysgol, a dylid cydnabod hyn yn gyffredinol. Yn yr un modd, dylid cydnabod y Dystysgrif Genedlaethol Uwch fel cymhwyster priodol i dechnegwr o radd uchel. Llwybr i'r lleiafrif ac nid i'r mwyafrif fel yn awr, i gyrraedd statws technolegwyr y dylai'r Dystysgrif Genedlaethol fod. I leiafrif o rai cymwys wedi ennil Tystysgrif Genedlaethol Gyffredinol dylai ddal yn llwybr ar yr amod fod y lleiafrif hyn yn cael eu rhyddhau o'u gwaith am yspeidiau mwy sylweddol i ddilyn y cwrs.

I raddau helaeth iawn, y mae'r allwedd i broblem darparu ar gyfer gofynion diwydiant am ddynion a chanddynt gymwysterau uchel yn nwylo'r diwydianwyr eu hunain. Y mae darpariaeth hyfforddi eisoes yn bod. Ond er fod diwydianwyr yn gyffredinol yn barod i ganiatáu rhyddhad dydd, ni chynigir yn gyffredinol gyfle i ddilyn cyrsiau rhyngosod uwch. Mae'r Cyngor yn mawr obeithio mai rhywbeth dros dro yw'r diffyg hwn. Rhaid cofio mai newydd-ddyfodiaid yw'r cyrsiau rhyngosod. Dylai diwydianwyr, prifathrawon colegau technegol ac awdurdodau addysg lleol wneud eu gorau glas i roi pob cyfle i rai cymwys i'w dilyn.

Rhaid nodi'n arbennig ddiffyg cefnogaeth i gyrsiau rhyngosod uwch mewn cemeg a chemeg ddiwydiannol yn Ne Cymru, oblegid y mae yma bellach doreth o ddiwydiannau cemegol. Saith myfyriwr, sef pedwar mewn cwrs amser-llawn a thri mewn cwrs rhyngosod, a ddilynai'r cyrsiau hyn yng Ngholeg Technoleg Uwch Cymru yn 1958-9. Pedwar yn unig, bob un yn syth o ysgol ramadeg, a geisiodd gychwyn cwrs Diploma Genedlaethol Uwch yn y Coleg ym Medi 1959; ni chynhaliwyd y cwrs am fod y nifer mor fychan. Heb ymateb gwell, fe ddaw adeg efallai pan fydd bodolaeth cyrsiau eraill mewn perygl. Y mae hyn oll yn wyneb y ffaith fod nifer helaeth o'r rhai a enillodd Dystysgrif Genedlaethol Uwch mewn Cemeg yn 1958 a 1959 wedi gwneud yn ddigon da i fedru'n deg obeithio bod yn ŵr gradd o'r *Royal Institute of Chemistry*, a bwrw eu bod yn cael cyfle. Byddai'n bosibl iddynt wneud hyn trwy arholiad Rhan I ar ôl cwrs rhyngosod tair blynedd ac yna Rhan II ar ôl cwrs rhyngosod pellach am ddwy flynedd neu gwrs amser-llawn am flwyddyn. Teg yw barnu na fyddai diwydiant yn llyncu cymaint o raddedigion prifysgol pe byddai diwudianwyr yn cefnogi o ddifrif addysg a hyfforddiant myfyrwyr addawol cwrs y Dystysgrif Genedlaethol. Fe fyddai cefnogi egniol yn debyg o lacio problem prinder athrawon graddedig mewn Gwyddoniaeth yn yr ysgolion.

Os bydd diffyg cefnogaeth i gyrsiau uwch mewn gwyddoniaeth a thechnoleg yng Ngholeg Technoleg Uwch Cymru yn parhau, yna yn sicr bydd yn bryd gofyn yn ddifrifol a oes lle yng Nghymru i goleg o'r safon yma. Mae rhai o ffyrmiau mwyaf Cymru yn llwyr anwybyddu cyfleusterau'r Coleg trwy ddanfon eu prentisiaid i gyrsiau rhyngosod uwch mewn colegau technolog uwch a cholegau technegol eraill yn Lloegr. Am hynny nid yw llawer o'r gefnogaeth a ddisgwylid pan sefydlwyd y Coleg Technegol Uwch yng Nghaerdydd wedi dod i'r golwg. Er hyn y mae'r Cyngor o'r farn y ceid digon o gefnogaeth i roi rhwydd hynt i'r Coleg ar y tri amod a ganlyn.

(a) rhaid i ddiwydiant fod yn barod i ryddhau rhai cymwys am y cyfnodau gofynnol o chwe mis i ddilyn cyrsiau rhyngosod Diploma Dechnoleg a chyrsiau uwch eraill;

(b) rhaid i brifathrawon colegau technegol gynghori a chymell y rhai sy'n rhagori yn arholiadau'r Dystysgrif Genedlaethol Gyffredinol i ddilyn cyrsiau rhyngosod uwch yn hytrach na dal ymlaen gyda chyrsiau'r Dystysgrif Genedlaethol Uwch. Rhaid iddynt hefyd egluro i fyfyrwyr fod grantiau awdurdodau addysg lleol ar gael i'w cynnal os bydd eu meistri gwaith yn gwrthod cymorth ariannol.

(c) rhaid cynllunio cyrsiau uwch y Coleg Technoleg a cholegau eraill i osgoi dyblu a chydredeg cyrsiau yn ddianghenraid.

Coleg Technoleg Uwch Cymru a Phrifysgol Cymru

Yr oedd yn rhaid i'r Cyngor hefyd ystyried y berthynas a allai fod rhwng Coleg Technoleg Uwch Cymru a Phrifysgol Cymru. Rhoddwyd braslun o waith y Coleg Technoleg a rhai o'i broblemau yma yn barod; rhoddwyd hefyd fraslun o gynlluniau'r Brifysgol ar gyfer gwyddoniaeth gymhwysol. Teg yw gofyn a oes cydweithrediad a chyd-ddealltwriaeth rhwng y Coleg Technoleg ac adrannau'r Brifysgol yn unol â gobaith y Papur Gwyn ar Addysg Dechnegol*. Oblegid teg fyddai disgwyl cydweithrediad rhwng rhai sy'n cyflwyno addysg dechnegol o gyfryw safon er bod y naill yn delio â chyrsiau rhyngosod Diploma Dechnoleg a'r llall â chyrsiau amser-llawn ar gyfer gradd prifysgol.

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* para. 75, Papur Gwyn Addysg Dechnegol 1956:
'Disgwylir i'r rhain (Colegau Technoleg Uwch) a phob coleg arall sy'n trin gwaith uwch glosio'n agos at y prifysgolion priodol. Gwneir hynny heddiw yn uniongyrchol a hefyd trwy Fyrddau Academaidd Rhanbarthol ar gyfer addysg dechnegol, lle y cydeistedda cynrychiolwyr awdurdodau addysg lleol, colegau technegol a diwydiant. Mae'n bur debyg y byddai'n bosibl cydffrwyno adnoddau prifysgolion a cholegau ar gyfer mwy o ymdrech nag a geir weithiau ar hyn o bryd'.

Ymddengys i'r Cyngor fod y Cymry at ei gilydd yn priodoli i addysg brifysgol fraint ac urddas sy'n fwy o lawer nag a briodolir i addysg dechnegol. Efallai na chafodd Coleg Technoleg Uwch Cymru yng Nghaerdydd eto'r amser i ennill ei blwyf ac na roddodd diwydianwyr Cymru iddo y gefnogaeth sy'n ddyledus iddo. Efallai bod eto ymhlith rhieni ac athrawon ysgolion gramadeg ragfarn yn erbyn addysg dechnegol y cymer amser i'w dileu. Efallai bod traddodiad a thymer meddwl Cymry yn gogwyddo tuag at ddysg llyfr a gysylltir â'r brifysgol yn hytrach nag at astudiaethau ymarferol y colegau technegol. Boed hyn fel y bo, ymddengys i'r Cyngor fod eisiau dangos i'r Cymry, yn athrawon, rhieni, diwydianwyr a disgyblion ysgol, fod addysg dechnegol o radd uchel y tu allan i'r brifysgol yn cynnig o ran disgyblaeth meddwl, rhyddid dewis a chyfle galwedigaeth gymaint ag addysg prifysgol ac mewn gwisg sy'n llawer mwy addas i aml un.

Cam pwysig tuag at greu y meddylddrych yma fyddai creu cysylltiad agos rhwng Coleg Technoleg Uwch Cymru a Phrifysgol Cymru. Nac anghofir fod Siarter ac Ystadudau Prifysgol Cymru yn cynnwys sylwadau manwl ar astudiaethau technegol ac efallai mai dyma'r adeg briodol i gyflawni bwriadau diymwâd rhai o sylfaenwyr y Brifysgol ac yn enwedig Coleg Caerdydd. Yn eu tyb hwy, yr oedd addysg dechnegol yn rhan o faes prifysgol. Er yr amser hwnnw, y mae'r Brifysgol wedi amgyffred fwyfwy ei chyfrifoldeb i'r gymdeithas ddiwydiannol sydd o'i hamgylch. Byddai'n cyfaddef heddiw yn fwy nag erioed o'r blaen fod pob gwybodaeth yn rhan o'i maes, boed wybodaeth ymarferol ddefnyddiol ai peidio, ymhell oddi wrth fywyd pob dydd neu yn rhan annatod ohono, ac mai'r unig amod y dylid ei chydnabod yw fod cyfle i chwilio pob gwybodaeth mewn rhyddid ac ar lefel uchaf cyraeddiadau meddwl dyn. Gellid dadlau fod y Prifathro Viriamu Jones a'i debyg, pan amlygodd ddiddordeb arbennig mewn addysg dechnegol, yn synio am rywbeth tra gwahanol i addysg dechnegol yn y wisg a adwaenwn ni heddiw. Dadleuwyd ger ein bron mai dod at wyddoniaeth trwy ymarfer ac arbrofi oedd y nod yn hytrach na pheri i'r Brifysgol ymdrechu'n fwriadol i gydweithio â diwydiant ym maes hyfforddiant ar y lefel uchaf i weithwyr diwydiannol. Anodd derbyn hyn, canys y mae Siarter y Brifysgol yn sôn am ffurfio Bwrdd Technoleg yn y Brifysgol. Y mae erthygl XXVI yn dweud, 'Bydd y Llys, ar argymhelliad y Cyngor, yn sefydlu Bwrdd, yn dwyn yr enw Bwrdd Technoleg y Brifysgol, i'r pwrpas o hyrwyddo addysg ac ymchwil dechnolegol ac i gynnal ymholiadau i'r pwrpas o wella dulliau diwydiannol a masnachol a bydd yn gosod allan, trwy Ystadud, gyfansoddiad, dyletswyddau ac awdurdad y Bwrdd hwn'.

Mae'r Siarter yn darparu hefyd ar gyfer Cyfadran Dechnoleg gyda'r graddau o faglor, meistr a doethor mewn Technoleg. Yn ôl y Siarter, un o ddyletswyddau'r Gyfadran fyddai 'rhoi cyngor i'r Bwrdd Academaidd ac i'r Cyngor ar ddatblygiad addysg ac ymchwil dechnolegol yng Nghymru'.

Dywedwyd digon i gadarnhau'r farn nad yw'r apêl am uniad closiach rhwng y Coleg Technolegol Uwch a'r Brifysgol yn anghyson â bwriadau'r Brifysgol yn ôl ei Siarter a'i Hystadudau. Yn sicr, dylid astudio'r holl fater yn fanwl. Nid oes amheuaeth na fyddai ieuad o ryw fath fel hyn yn esgor ar fanteision pendant. Byddai mwy o fri ar astudiaethau technegol yng Nghymru. Credwn y byddai mwy yn dilyn cyrsiau uwch gyda chefnogaeth barotach oddi wrth gyflogwyr. Yn ddiau, byddai anawsterau gweinyddol a phersonol ar y dechrau ond tyfai trefn hwylusach a rhatach gogyfer ag offer a staff a byddai myfyrywr ar eu hennill o gael addysg fwy amrywiol a mwy cyfoethog. Mantais arall go fawr a ddeilliai o hyn fyddai'r llinell derfyn gliriach ac amlycach a wahanai'r Coleg Technoleg oddi wrth y colegau technegol eraill sy'n darparu cyrsiau uwch. Byddai hefyd yn gam tuag at ddatblygu patrwm cliriach i sefydliadau addysg technegol yng Nghymru, patrwm y sylwyd arno eisoes yma.

Rhanbartholi Cyrsiau Uwch

Ar ddechrau'r bennod, sylwyd fod darpariaeth rhai sefydliadau yn fwy na'r gofyn. Dyma enghraifft: Yn sesiwn 1959-60, allan o 528 o gyrsiau uwch mewn 24 coleg technegol yng Nghymru, y mae nifer mynychwyr 384 o'r cyrsiau yn llai na'r nifer y bernir ei fod yn angenrheidiol ar gyfer rhedeg cyrsiau uwch yn foddhaol yn ôl Memorandwm Gweinyddu 545 y Weinyddiaeth (Mawrth laf, 1957). Gan fod offer angenrheidiol i gyrsiau uwch yn ddrud, a staff cymwys yn brin, mae hyn yn beth gresynus. Mewn nifer o achosion, bydd dau, neu hyd yn oed dri, dosbarth a fo'n cynrychioli gwahanol flynyddoedd mewn cwrs arbennig yn cydweithio fel un dosbarth er mwyn ceisio cael nifer digonol. Mae'n ddigon posibl y gall y gwastraff hwn arwain yn y pen draw i ymyrraeth o du'r Weinyddiaeth Addysg a gwanhau, o ganlyniad, reolaeth yr awdurdodau lleol. Oni fyddai'n deg disgwyl i awdurdodau addysg lleol wynebu'r problemau hyn gyda rhagolwg ehangach, ac o safbwynt rhanbarthol a chenedlaethol yn hytrach nag o safbwynt lleol? Mae peirianwaith trefnu dros ardal fwy eang yn bod gan fod cyfrifoldeb cyfanu'r gwaith ar y lefel yma wedi ei osod ar y Cyd-Bwyllgor Addysg Cymreig. Ond nid hawdd setlo'r broblem. Er bod darpariaeth leol yn achosi gwastraff, mae'n debyg hefyd o ddenu mwy o fyfyrwyr. Canys byddai llai o gyrsiau yn gofyn am barodrwydd i deithio ac yn wir yn gofyn yn gyffredinol am fwy o ymdrech gan fyfyrwyr. Canlyniad hyn fyddai llai ohonynt. Yn naturiol, mae awdurdodau addysg lleol yn awyddus i ddarparu ar gyfer gofynion myfyrwyr lleol hyd yr eithaf. Un ateb fyddai cyfyngu ar gyrsiau uwch, yn arbennig rhai cyrsiau Tystysgrif a Diploma Genedlaethol, a'u cadw mewn rhai colegau technegol Cymreig yn unig o dan reolaeth Cyngor Gweinyddu. Gallai Is-bwyllgor Technegol y Cyd-Bwyllgor Addysg Cymreig fod yn Gyngor Gweinyddu neu gallai'r Is-bwyllgor benodi Cyngor o rai a chanddynt ddiddordeb arbennig mewn addysg dechnegol ond heb fod o angenrheidrwydd yn cynrychioli buddiannau arbennig, Byddai'r Cyngor yn annibynnol ac yn gweinyddu grantiau oddi wrth awdurdodau addysg lleol a'r Weinyddiaeth. Byddai hefyd yn penodi corff llywodraethol i bob coleg. Credwn y byddai pum coleg yn ddigon sef Coleg Technoleg Morgannwg yn Nhrefforest, Coleg Technoleg Casnewydd a Mynwy yng Nghasnewydd, Coleg Technegol Abertawe a'r Coleg Technoleg Uwch yng Nghaerdydd, y rhain yn y de, a Choleg Technegol Sir Ddinbych yn Wrecsam yn y gogledd. Byddai'r rhain yn ddigon i ateb gofynion presennol Cymru am gyrsiau uwch, a'r unig eithriadau fyddai cyrsiau arbennig coleg technegol lleol lle mae gwaith diwydiannol arbennig yn gofyn am y cyrsiau ac yn sicrhau nifer digonol o fyfyrwyr. Ceir enghreifftiau o hyn yng nghwrs peirianneg gemegol Coleg Castell-nedd a chwrs metaleg Coleg Technegol Sir Fflint. Felly, awgrymwn fod cyrsiau uwch Cymru, heblaw'r eithriadau hyn, i'w lleoli yn y pum coleg a nodwyd ac o dan reolaeth Cyngor Gweinyddu.

Yn y gwaith cynnil o ranbartholi cyrsiau uwch ac o gydgysylltu, lle bo angen, astudiaethau uwch prifysgol a cholegau technegol, ymddengys i'r Cyngor fod lle i ail-godi'r Bwrdd Technoleg Cymreig a gychwynnwyd yn 1946 ar awgrym Adroddiad pwyllgor yr Arglwydd Eustace Percy ar Addysg Dechnolegol Uwch. Yn fuan wedyn peidiodd y Bwrdd â gweithredu o achos anawsterau ynglŷn â'r cyfansoddiad. Dylid pwysleisio mai Bwrdd ymgynghorol fyddai, ond y mae'r Cyngor yn sicr y byddai lle pwysig iddo yng Nghymru.

Ym maes rheoli a gweinyddu colegau technegol yn gyffredinol, mae'r cyrff llywodraethol wedi eu penodi gan yr awdurdodau addysg lleol ac yn amrywio'n fawr yn eu cyfansoddiad ac ym maint eu cyfrifoldeb. Gellir mesur y cyfrifoldeb yn ôl gallu'r corff llywodraethol (a) i wario arian o fewn amcangyfrifon blynyddol heb ymgynghoriad pellach â'r awdurdod a (b) i benodi staff. Hoffai rhai a roddodd dystiolaeth ger bron y Cyngor, weld mwy o allu llywodraethol yn nwylo diwydianwyr, undebau llafur a rhai a chanddynt wir ddiddordeb mewn materion technegol a gwybodaeth ohonynt. Ym marn y Cyngor, y peth pwysig yw sicrhau gwasanaeth y rhai mwyaf cymwys, heb geisio ystyried pa fuddiannau a gynrychiolant. Am hynny, ni chefnogai'r Cyngor drefn wedi ei seilio ar gyfartaledd penodedig o rai yn cynrychioli buddiannau arbennig ac yn sicr ni fyddai'n dal fod yn rhaid wrth fwyafrif o gynrychiolwyr yr awdurdod addysg lleol. Ond, er hyn, rhaid cofio fod yr awdurdod terfynol yn gorwedd gyda'r awdurdod hwnnw ac mai felly y dylai fod.

Crynodeb o Sylwadau ac Argymhellion

Prentisiaid Crefft

(1.) Y mae derbyniad i brentisiaeth grefft yn dibynnu'n ormodol ar hap a damwain ac yn tueddu i ateb gofynion diwydiant o ddydd i ddydd yn hytrach na'r angen dros hir amser. (*Tudalen* 107.)

(2) Y mae eisiau llacio cyfyngiad yr Undebau Llafur ar ucbafrif derbyniadau prentisiaid crefft i alwedigaeth arbennig. Dylid cadw llygad yn hytrach ar ofynion y wlad yn gyfan. (*Tudalen* 107.)

(3.) Y mae llawer ffyrm yng Nghymru, sydd heb allu i ddarparu hyfforddiant teilwng, yn peidio â derbyn prentisiaid crefft. O dan Gynlluniau Prentisiaeth Grwp, megis a welir mewn rhannau o Loegr, byddent yn gallu derbyn rhai. (*Tudalen* 107.)

(4.) Er holl rym traddodiad teuluol mewn crefft, ni ddylai gwaed fod yn gryfach na chymwysterau addysgol a theithi personol pan ddewisir prentisiaid. (*Tudalen* 108.)

(5.) Ni ddylai plant sy'n dal i fod yn yr ysgol dros un-ar-bymtheg oed golli'r cyfle i dderbyn prentisiaeth grefft. (*Tudalen* 108.)

(6) Gellid er mantais estyn darpariaeth bresennol rhai colegau technegol, a rydd hyfforddiant galwedigaethol rhag-baratoawl i blant '15+', i ysgolion uwchradd modern, a bwrw y ceid athrawon ac offer addas. (*Tudalen* 108.)

(7) Dylai cyflogwyr ryddhau prentisiaid heb goll cyflog i ddilyn cyrsiau coleg technegol drwy holl gyfnod eu prentisiaeth, ar yr amod eu bod yn llwyddo'n foddhaol. (*Tudalen* 109.)

(8) Y mae cyrsiau rhyddhad cryno yn rhagori ar gyrsiau rhyddhad dydd (*Tudalen* 109.)

(9) Y mae eisiau gwahaniaethu rhwng hyfforddiant prentis crefft mewn medrau arbennig ar y naill law, a'i addysg ar y llaw arall. Dylai addysg roi iddo'r gallu i feistroli medrau newydd fel y dont i'w ran. (*Tudalen* 106.)

(10) Dylid rhoi'r gorau i'r Dystysgrif Genedlaethol Ragbaratoawl a blwyddyn gyntaf (S.1) cwrs y Dystysgrif Genedlaethol, a dylid derbyn i'r Cwrs ar lefel yr ail flwyddyn bresennol (S.2). Pedwar pwnc addas ar Dystysgrif lefel Gyffredinol y *G.C.E.*, wedi boddhau'r arholwyr ynddynt ar ddim mwy na dau gynnig, a ddylai fod yn gymhwyster normal ar gyfer dechrau ar y cwrs hwn. (*Tudalen* 109.)

(11) Dylai awdurdodau addysg lleol, cyrff llywodraethol a phrifathrawon colegau technegol geisio darparu cyrsiau mewn dulliau dysgu i athrawon hyd eithaf eu gallu, a hefyd wneud eu gorau i gael gan athrawon rhan-amser ac amser-llawn colegau technegol eu dilyn, oni fyddant wedi dilyn cyrsiau hyfforddi athrawon eisoes. (*Tudalen* 110.)

(12) Gellid cywiro tipyn ar agwedd ddidaro rhai myfyrwyr at eu gwaith a'r aflwyddiant sydd yn dilyn hynny trwy i rieni ac awdurdodau coleg a diwydiant arolygu eu gwaith yn aml a'u calonogi. (*Tudalen* 111.)

(13) Croesewir yr arfer o gynnal arholiadau ychwanegol llai academaidd a mwy ymarferol a gychwynnwyd gan y *City and Guilds of London Institute* yn ddiweddar, fel un cais i leihau aflwyddiant ymhlith rhai sy'n dilyn cyrsiau crefft. (*Tudalen* 112.)

(14) Cyfrifoldeb cenedlaethol yw derbyn ac hyfforddi prentisiaid crefft, a chymeradwyir sefydlu trefn brentisiaeth crefft genedlaethol. (*Tudalen* 113.)

(15) Fel ail ddewis, os gwrthodir (14), awgrymir byrhau hyd prentisiaeth grefft i dair blynedd, ar yr amod bod diwydiant yn derbyn prentis yn 17—18 oed ar ôl iddo ddilyn cwrs arbennig mewn pynciau sylfaenol am ddwy flynedd. (*Tudalen* 114.)

(16) Gobeithir gweld diwydiant a Phrifysgol Cymru yn dal i annog myfyrwyr, gyda chymwysterau Tystysgrif Genedlaethol yn lle matric, i ddilyn cyrsiau gradd, yn enwedig gan fod llawer ohonynt wedi bod yn llwyddiannus yn y Brifysgol yn ddiweddar. (*Tudalen* 86.)

Cyrsiau Uwch

(17) Cyrsiau rhyngosod uwch diploma a chyrsiau gradd prifysgol ddylai fod y llwybrau arferol i gyrraedd statws technolegwr. (*Tudalen* 115.)

(18) Rhaid gobeithio mai rhywbeth dros dro yw'r diffyg diddordeb a welir ar hyn o bryd mewn cyrsiau rhyngosod uwch ac y bydd i bawb wneud eu gorau i helpu pawb teilwng i'w mynychu. (*Tudalen* 115.)

(19) Mae diffyg cefnogaeth i gyrsiau rhyngosod mewn cemeg a chemeg ddiwydiannol yn Ne Cymru, lle y ceir casgliad o ddiwydiannau cemegol, yn peri cryn bryder. Yn arbennig, pe byddai'r diwydiant cemegol yn gwir gefnogi addysg ac hyfforddiant rhai addawol sy'n dilyn cwrs y Dystysgrif Genedlaethol, byddai llai o brinder athrawon a chanddynt radd mewn Gwyddoniaeth yn yr ysgolion. (*Tudalen* 116.)

Coleg Technoleg Uwch Cymru

(20) Mae diffyg cefnogaeth i gyrsiau rhyngosod uwch y coleg hyd yn hyn yn gwestiwn a all godi amheuaeth ynghylch cyfiawnhau bodolaeth coleg o'r safon yma yng Nghymru. Rhaid wrth well cydweithrediad â diwydiant a cholegau technegol eraill i wella'r sefyllfa. (*Tudalen* 116.)

(21) Byddai perthynas agos rhwng y Coleg a Phrifysgol Cymru yn codi statws

addysg dechnegol yng Nghymru ac y mae felly yn fater y dylid ei ystyried yn fanwl. *(Tudalen 117.)*

Rhanbartholi Cyrsiau Uwch

(22) Y mae'r ddarpariaeth gyffredinol yng Nghymru ar gyfer cyrsiau uwch ymhell ar y blaen i'r gofyn sydd amdanynt ar hyn o bryd. I atal gwastraff, dylai'r cyrsiau yma, sy'n gofyn am staff a chanddynt gymwysterau uchel a hefyd offer drud, gael eu cyfyngu i bum coleg technegol a dylid rheoli'r pump gan Gyngor Gweinyddol. *(Tudalen 118.)*

(23) Dylid ail-godi y Bwrdd Technolegol Cymreig ar fyrder. Ffurfiwyd ef gyntaf yn 1946 ond dadfeiliodd yn 1948 *(Tudalen 118.)*

Cyrff Llywodraethol Colegau Technegol

(24) Y dynion gorau ar gyfer y gwaith a ddylai fod yn aelodau o gyrff llywodraethol. Am hynny, ni ddylid pennu cyfartaledd rhagosodedig o gynrychiolwyr buddiannau arbennig ac ni ddylid ystyried fod yn rhaid bod y mwyafrif yn aelodau'r pwyllgor addysg lleol. *(Tudalen 119.)*

Cyffredinol

(25) Mae prinder athrawon addas eu cymwysterau mewn gwyddoniaeth a mathemateg yn lleihau'r nifer o ferched sy'n astudio'r pynciau hyn y tu hwnt i safon elfennol ac hefyd yn rhwystro diwydiant rhag derbyn gwasanaeth rhai a allai ennill statws technegwyr neu dechnolegwyr gyda chyfle. Hyd nes y ceir cyflenwad digonol o athrawon, dylid trefnu i uno dosbarthiadau chweched dosbarth ysgolion bechgyn ac ysgolion merched cyfagos, os yw hynny yn bosibl *(Tudalen 95.)*

(26) Er bod dyfodiad diwydiannau newydd i Gymru er y rhyfel wedi cryfhau economeg y wlad, ar dir cymdeithasol yn ogystal ag ar dir economaidd, cefnogir ychwanegu at yr amrywiaeth trwy gynnwys diwydiannau sy'n gofyn am gyfartaledd uchel o weithwyr medrus. *(Tudalen 96.)*

Appendix A

Courses pursued during the session 1958-59 *by students who gained their Ordinary National Certificates at Technical Colleges in Wales in the session* 1957-58

(a) Obtained 60 per cent or over in each paper of the Ordinary National Certificate examination and eligible for admission to a Diploma in Technology course, a Higher National Diploma course, or a Higher National Certificate course.

(b) Obtained 50 per cent or over in each paper of the Ordinary National Certificate examination and eligible for admission to a Higher National Diploma course or a Higher National Certificate course.

(c) Obtained 40 per cent or over in each paper of the Ordinary National Certificate examination and eligible for admission to a Higher National Certificate course.

Ordinary National Certificate gained 1957-58		Courses pursued during 1958-59 Session						
		University	Diploma in Technology	Higher National Diploma	Higher National Certificate	Her Majesty's Forces	Not Known	Total
Building	(a)				4		3	7
	(b)				12	2	5	19
	(c)				19		8	27
								53
Applied Physics	(a)				6			6
	(b)				8		3	11
	(c)				3		1	4
								21
Chemistry	(a)	2		1	19		1	23
	(b)			1	27		3	31
	(c)				36		6	42
								96
Electrical Engineering	(a)	2		1	25		7	35
	(b)				50		14	64
	(c)			1	42	1	20	64
								163
Mechanical Engineering	(a)	2	3	1	49		17	72
	(b)			1	65	1	16	83
	(c)	1		1	103	5	42	152
								307
Metallurgy	(a)	1			4			5
	(b)				5			5
	(c)	1			18		5	24
								34
Mining	(a)	1		2	15		6	24
	(b)			2	26		3	31
	(c)			6	61		4	71
								126
TOTALS ...		10	3	17	597	9	164	800

Appendix B

Welsh College of Advanced Technology

Enrolments in Advanced Sandwich Courses, 1958-59

Home Authorities	Mechanical Engineering						Electrical Engineering				Building			Totals
	D.T.1	D.T.2	D.T.3	H.D.1	H.D.2	H.D.3	D.T.1	H.D.1	H.D.2	H.O.3	H.D.1	H.D.2	H.D.3	
Cardiff	6	1	6	1	2	1	–	1	1	1	–	1	1	22
Glamorgan	1	5	1	–	3	3	2	–	2	1	–	3	1	22
Monmouthshire	1	4	–	2	2	–	2	–	1	1	–	–	2	15
Newport	3	2	3	1	4	–	–	1	2	1	–	3	–	20
Merthyr	4	–	–	–	–	–	–	–	–	–	1	–	1	6
Swansea	–	1	1	–	–	–	–	–	–	–	–	1	–	3
Breconshire	1	–	–	–	–	–	–	–	–	–	–	1	1	3
Carmarthenshire	1	–	–	–	–	–	–	1	–	–	2	–	–	4
Denbighshire	1	–	–	–	–	–	–	–	–	–	–	–	–	1
Pembrokeshire	–	1	–	–	–	–	1	–	1	–	–	1	–	4
Cardiganshire	–	–	–	–	–	–	1	–	–	–	–	–	–	1
Caernarvonshire	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Montgomeryshire	–	–	–	–	–	–	–	–	–	–	–	1	1	2
Cheshire	1	–	–	–	–	–	–	–	–	–	–	–	–	1
Lancashire	1	–	–	–	–	–	–	–	–	–	–	–	–	1
Worcestershire	1	–	–	–	–	–	–	–	–	–	–	–	–	1
Manchester...	–	–	1	–	–	–	–	–	–	–	–	–	–	1
Cyprus	–	–	–	–	–	–	–	–	–	–	1	2	1	4
India	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Iraq...	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Sierra Leone	–	–	–	–	–	–	–	–	–	–	–	1	–	1
Ghana	–	–	–	–	–	–	–	–	–	–	–	1	–	1
TOTALS	21	14	12	4	11	4	6	3	7	4	7	15	8	116
Grants or Awards														
Wages paid by industry	16	12	12	3	9	2	5	1	5	3	–	2	1	71
Local education authority grants or awards	–	2	–	–	1	–	1	–	2	–	4	8	3	21
Technical state scholarship ...	5	–	–	–	–	–	–	–	–	–	–	–	–	5
Overseas Government grants ...	–	–	–	–	–	–	–	–	–	–	1	2	1	4
Students receiving no grants ...	–	–	–	1	1	2	–	2	–	1	2	3	3	15

D.T. = Diploma in Technology (Dip. Tech.); H.D. = Higher National Diploma (including some Structural Engineering students in Building).

Appendix C

Glamorgan College of Technology

Students attending Advanced Sandwich Courses 1958-59

Home Authorities	Mechanical Engineering				Electrical Engineering				Civil Engineering				Chemical Engineering				Mining				Physics				Total
	HD 1	HD 2	HD 3	HD 4	HD 1	HD 2	HD 3	HD 4	CD 1	CD 2	CD 3	CD 4	CD 1	CD 2	CD 3	CD 4	ND 1	ND 2	ND 3	ND 4	CD 1	CD 2	CD 3	CD 4	
Glamorgan	12	14	4	6	9	6	3	4	10	4	7	3	7	3	5	–	1	7	–	4	8	6	–	1	124
Cardiff	–	–	–	–	–	–	–	–	1	1	–	–	–	1	–	–	–	–	–	1	–	–	–	–	4
Monmouthshire	3	3	1	1	3	6	–	2	–	2	1	–	–	–	–	–	3	2	–	4	–	–	–	–	31
Rhondda	2	5	3	1	2	2	2	–	3	–	1	1	4	2	–	1	1	–	–	2	1	1	–	1	35
Merthyr	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	4
Swansea	–	1	–	–	1	–	1	–	–	1	1	–	–	1	–	–	–	–	–	–	–	–	–	–	6
Breconshire	–	–	1	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	–	–	–	–	–	–	3
Carmarthenshire	–	2	–	–	–	1	2	–	–	–	–	–	2	1	1	–	1	2	–	3	–	–	–	–	15
Cardiganshire	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Pembrokeshire	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	2
Buckinghamshire	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Gloucestershire	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1
Herefordshire	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Somerset	–	–	–	–	–	–	–	–	1	–	1	–	–	1	–	–	4	1	–	–	–	–	–	–	8
Overseas	–	–	–	–	1	–	–	–	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	3
TOTALS ...	18	28	9	8	16	16	8	6	17	8	12	5	14	10	6	1	10	14	–	15	10	7	–	2	240
Grants or Awards																									
Released with pay from industry	8	10	7	1	9	15	7	5	1	1	5	–	–	2	–	–	10	14	–	15	–	–	–	–	110
Local education authority grants or scholarships ...	4	17	1	5	4	1	–	1	9	4	5	1	10	6	6	1	–	–	–	–	5	6	–	2	88
Overseas Government grants	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Students receiving no grants	6	1	1	2	3	–	1	–	7	3	2	4	4	2	–	–	–	–	–	–	5	1	–	–	42

H.D. = Higher National Diploma; N.D. = National Diploma; C.D. = College Diploma.

Appendix D

Full-time students pursuing Graduate and Post-graduate Courses in Arts, Science and Applied Science at the University of Wales, from 1937-38 to 1957-58

Year	Arts		Science		Applied Science	
	Graduate Courses	Post-graduate	Graduate Courses	Post-graduate	Graduate Courses	Post-graduate
1937-38	1,192	50	544	88	128	—
1938-39	1,072	57	464	82	153	2
1939-40	1,004	53	422	67	170	2
1940-41	862	17	357	19	170	3
1941-42	800	13	473	10	180	2
1942-43	746	12	481	7	219	—
1943-44	682	10	442	11	217	—
1944-45	775	11	493	13	205	—
1945-46	965	22	623	38	258	—
1946-47	1,535	35	857	59	384	1
1947-48	1,809	39	1,095	73	456	1
1948-49	1,906	47	1,188	78	474	12
1949-50	1,887	60	1,336	88	457	16
1950-51	1,783	57	1,304	106	424	22
1951-52	1,658	59	1,208	112	389	18
1952-53	1,576	59	1,130	134	362	17
1953-54	1,490	64	1,054	125	341	18
1954-55	1,432	72	1,104	144	364	17
1955-56	1,499	79	1,185	151	400	16
1956-57	1,677	89	1,337	161	459	24
1957-58	1,778	171	1,431	208	532	38

Appendix E

Secondary Technical Schools (known as Junior Technical Schools pre-1944) in Wales

School	Opened	Closed
Newport	1916	1958
Cardiff	1917	1931
Newport (Nautical)	1918	1924
Cardiff (Smith Nautical)	1921	1954
Rhondda	1024	1959
Cardiff (Commerce)	1924	1931
Newport (Commerce)	1924	1958
Abersychan	1929	1956
Pontllanfraith	1930	1959
Abertillery	1930	—
Caerphilly	1930	1953
Ebbw Vale	1930	—
Bargoed	1931	1959
Bridgend	1931	—
Neath	1931	—
Pontardawe	1933	—
New Tredegar	1934	—
Wrexham	1934	—
Tredegar	1935	—
Swansea	1936	—
Merthyr Tydfil	1937	1955
Ammanford	1942	—
Llanelly	1942	1956
Newtown	1943	—
Rhydyfelin	1943	—
Cardiff (Junior Building)	1942	1952
Cardiff (Fitzalan School)	1953	—
*Swansea (Commerce)	1955	—

* Prior to 1955 the Secondary Technical School at Swansea was a mixed school. The girls moved to a separate building in 1955.

Appendix F

Major Establishments for Further Education in Wales
(excluding Art and Agricultural Establishments)

Symbols in Column 2

F.T.	Full-time Courses	B.R.	Block-release Courses
P.T.D.	Part-time Day Courses	Evg.	Evening Courses
S.C.	Sandwich Courses	(S.T.S.)	Secondary Technical School in same premises

Symbols in Column 3 (indicating main branches of work only)

Bldg.	Building	Com.	Commercial Subjects
Eng.	Engineering	Acad.	Academic and Pre-professional
Mng.	Mining	Cky. & Ctg.	Cookery & Catering (large scale)
Naut.	Nautical Subjects	Wom.	Women's occupations including Domestic Subjects, Needle trades and Pre-nursing
Agr.	Agricultural Subjects		
Sc.	Science (includes technologies such as Metallurgy and Fuel Technology)	Ad.	Adult (Liberal and cultural)

Name of Establishment	Range of Courses	Scope of Work
Anglesey		
Holyhead Technical Institute	P.T.D., Evg.	Bldg., Eng.
Llangefni College of Further Education	P.T.D., Evg.	Agr., Wom.
Breconshire		
Ystradgynlais, Maesydderwen Mining and Technical Institute	P.T.D., Evg.	Bldg., Eng., Mng., Com.
Caernarvonshire		
Bangor, Caernarvonshire Technical College	P.T.D., Evg.	Bldg., Eng., Com., Ad., Sc.
Bangor, Normal College	F.T.	Wom.
Llandudno Hotel and Catering School	F.T., P.T.D.	Cky. & Ctg.
Pwllheli Day Continuation School and Evening Institute	P.T.D., Evg.	Gen. Educ., Wom.
Cardiganshire		
Aberystwyth College of Further Education	F.T., P.T.D., Evg.	Bldg., Eng., Sc., Com., Ad., Wom.
Cardigan, County Grammar School	P.T.D., Evg.	Eng., Sc.
Felinfach, Canolfan Addysg Ffermwyr	P.T.D., Evg.	Agr., Wom.
Carmarthenshire		
Ammanford Technical College	F.T., P.T.D., Evg. (S.T.S.)	Bldg., Eng., Mng., Com., Wom.
Llanelly Technical College	F.T., P.T.D., Evg.	Bldg., Eng., Com., Sc. Wom.
Pibwrlwyd Rural Technical College	F.T., P.T.D., Evg.	Bldg., Eng., Agr., Com., Wom.
Denbighshire		
Colwyn Bay Technical Institute	F.T., P.T.D., Evg.	Bldg., Eng., Com., Wom.
Wrexham, Denbighshire Technical College	F.T., S.C., P.T.D., Evg. (S.T.S.)	Bldg., Eng., Mng., Sc., Com., Wom., Ad.
Flintshire		
Connah's Quay, Flintshire Technical College	F.T., S.C., P.T.D., Evg.	Bldg., Eng., Sc., Com., Wom.

Name of Establishment	Range of Courses	Scope of Work
Glamorgan		
Aberdare College of Further Education	F.T., P.T.D., Evg.	Bldg., Eng., Mng., Sc., Com., Wom., Ad.
Barry College of Further Education	F.T., P.T.D., Evg.	Eng., Sc., Com., Ad., Wom.
Bridgend Technical College	F.T., P.T.D., Evg. (S.T.S.)	Bldg., Eng., Mng., Sc., Wom., Com.
Gorseinon College of Further Education	F.T., P.T.D., Evg.	Eng., Com., Wom., Ad.
Neath Technical College	F.T., P.T.D., Evg. (S.T.S.)	Bldg., Eng., Mng., Sc., Com., Wom.
Pontardawe Mining and Technical Institute	F.T., P.T.D., Evg. (S.T.S.)	Eng., Mng., Com.
Port Talbot College of Further Education	F.T., P.T.D., Evg.	Bldg., Eng., Com., Ad., Wom.
Rhondda College of Further Education	F.T., P.T.D., Evg.	Bldg., Eng., Mng., Com., Wom., Ad.
Treforest, Glamorgan College of Technology	F.T., S.C., P.T.D., Evg., (S.T.S.)	Bldg., Eng., Mng., Sc., Acad., Com., Wom.
Ystrad Mynach College of Further Education	F.T., P.T.D., Evg.	Bldg., Eng., Mng., Com., Wom.
Cardiff, College of Music and Drama	F.T., P.T.D., Evg.	Music, Drama
Cardiff, Welsh College of Advanced Technology	F.T., S.C., P.T.D., Evg.	Bldg., Eng., Sc., Com., Acad.
Cardiff, Llandaff Technical College	F.T., B.R., P.T.D., Evg.	Bldg., Eng., Sc., Com., Acad.
Cardiff, G.P.O. Continuation Classes (Day Release Classes)	P.T.D.	Gen. Educn.
Cardiff, College of Food Technology	F.T., P.T.D., Evg.	Bakery and Catering
Cardiff, Nursery Training Centre	P.T.D.	Wom.
Cardiff, Reardon Smith Nautical College	F.T.	Naut.
Merthyr Tydfil College of Further Education	F.T., P.T.D., Evg.	Bldg., Eng., Sc., Com., Wom., Ad.
Swansea Technical College	F.T., P.T.D., Evg.	Bldg., Eng., Mng., Sc., Com., Ad., Wom.
Monmouthshire		
Abertillery Mining and Technical Institute	P.T.D., Evg. (S.T.S.)	Eng., Mng., Wom., Com.
Bedwellty, New Tredegar Mining and Technical Institute	P.T.D., Evg. (S.T.S.)	Eng., Mng., Com., Wom.
Crumlin, Monmouthshire Technical College	F.T., P.T.D., Evg.	Eng., Mng., Sc., Com., Wom.
Ebbw Vale Mining and Technical Institute	P.T.D., Evg. (S.T.S.)	Eng., Ad., Com., Wom.
Pontypool, College of Further Education	F.T., P.T.D., Evg.	Bldg., Eng., Mng., Com., Wom.
Newport Nursery Training Centre	P.T.D.	Wom.
Newport College of Further Education	F.T., P.T.D., Evg.	Bldg., Eng., Sc., Com., Wom.
Newport-Monmouthshire College of Technology	F.T., S.C., B.R., P.T.D., Evg.	Eng., Sc.
Montgomeryshire		
Newtown County Technical School	F.T., B.R., P.T.D., Evg., (S.T.S.)	Bldg., Eng., Com., Agr.
Pembrokeshire		
Neyland Technical College	F.T., P.T.D., Evg.	Bldg., Eng, Com., Wom.

Appendix G

Estimated numbers of insured employees in Wales in 1948 and 1958

Industry	End of June 1948			End of May 1958		
	Males	Females	Total	Males	Females	Total
Agriculture, Forestry, Fishing ...	32,720	5,550	38,270	23,800	2,610	26,410
Agriculture and horticulture ...	27,290	5,390	32,680	18,920	2,360	21,280
Forestry	2,860	100	2,960	4,020	230	4,250
Fishing	2,570	60	2,630	860	20	880
Mining And Quarrying	144,040	1,620	145,660	125,730	2,870	128,600
Coal mining...	132,680	1,450	134,130	116,940	2,610	119,550
Iron ore and mining and quarrying	300		300	580	10	590
Stone quarrying and mining ...	5,810	130	5,940	4,360	210	4,570
Slate quarrying and mining... ...	4,650	30	4,680	3,300	30	3,330
Clay, sand, gravel and chalk pits ...	440		440	420	10	430
Other mining and quarrying ...	160	10	170	130	—	130
Treatment of Non-Metalliferous Mining Products Other Than Coal	9,990	1,210	11,200	10,290	1,450	11,740
Bricks and fireclay goods	4,590	290	4,880	4,350	440	4,790
China and earthenware (including glazed tiles)	130	100	230	170	120	290
Glass (other than containers) ...	950	480	1,430	980	330	1,310
Glass containers	120	100	220	150	220	370
Cement	700	40	740	1,220	90	1,310
Other non-metalliferous mining manufactures	3,500	200	3,700	3,420	250	3,670
Chemicals and Allied Trades ...	16,210	3,490	19,700	21,410	3,700	25,110
Coke ovens and by-product works	1,980	30	2,010	3,280	20	3,300
Chemicals and dyes	5,810	870	6,680	9,100	1,130	10,230
Pharmaceutical preparations, toilet preparations, perfumery	180	350	530	230	420	650
Explosives and fireworks	5,760	1,850	7,610	5,250	1,680	6,930
Paint and varnish	220	40	260	340	70	410
Soap candles, glycerine, polishes, ink and matches	100	130	230	90	120	210
Mineral oil refining	1,960	190	2,150	2,560	190	2,750
Other oils, greases, glue, etc. ...	200	30	230	560	70	630
Metal Manufacture	72,830	7,900	80,730	79,670	6,190	85,860
Blast furnaces	1,620	40	1,660	4,470	60	4,530
Iron and steel melting, rolling etc. not elsewhere specified	26,110	1,950	28,060	35,150	1,930	37,080
Iron foundries	5,460	280	5,740	5,850	600	6,450
Tinplate manufacture	14,180	2,780	16,960	8,830	1,080	9,910
Steel sheet manufacture	12,610	640	13,250	14,300	740	15,040
Iron aod steel tubes (including melting and rolling in integrated works)	2,350	110	2,460	2,250	220	2,470
Non-ferrous metals smelting, rolling, etc.	10,500	2,100	12,600	8,820	1,560	10,380

Industry	End of June 1948			End of May 1958		
	Males	Females	Total	Males	Females	Total
ENGINEERING, SHIPBUILDING AND ELECTRICAL GOODS	27,710	8,360	36,070	36,600	11,260	47,860
Shipbuilding and ship repairing ...	8,800	210	9,010	6,890	250	7,140
Marine engineering	460	30	490	30	—	30
Agricultural machinery (excluding tractors)	1,040	180	1,220	800	150	950
Boilers and boilerhouse plant ...	20	—	20	340	50	390
Machine tools and engineer's small tools	700	70	770	1,470	300	1,770
Stationary engines	—	10	10	20	—	20
Textile machinery and accessories ...	40	10	50	40	10	50
Ordnance and small arms	1,630	730	2,360	1,820	490	2,310
Constructional engineering... ...	2,280	540	2,820	5,260	260	5,520
Other non-electrical engineering ...	6,640	1,260	7,900	8,980	1,870	10,850
Electrical machinery	1,020	620	1,640	2,350	540	2,890
Electrical wires and cables	1,720	930	2,650	2,280	1,020	3,300
Telegraph and telephone apparatus	280	340	620	570	180	750
Wireless apparatus (excluding valves) and gramophones	560	900	1,460	1,240	2,580	3,820
Wireless valves and electric lamps ...	270	350	620	180	400	580
Batteries and accumulators... ...	40	10	50	370	210	580
Other electrical goods	2,210	2,170	4,380	3,960	2,950	6,910
VEHICLES	23,220	4,930	28,150	25,990	5,180	31,170
Manufacture of motor vehicles and cycles	2,720	530	3,250	2,340	660	3,000
Motor repairers and garages ...	8,580	860	9,440	11,280	1,720	13,000
Manufacture and repair of aircraft	2,270	320	2,590	1,960	270	2,230
Manufacture of parts and accessories for motor vehicles and aircraft ...	4,710	2,390	7,100	4,330	2,110	6,440
Railway locomotive shops	1,280	10	1,290	1,000	20	1,020
Manufacture and repair of railway carriages and wagons and trains...	3,340	100	3,440	4,800	160	4,960
Carts, perambulators, etc.	320	720	1,040	280	240	520
METAL GOODS NOT ELSEWHERE SPECIFIED	10,420	7,190	17,610	12,870	8,100	20,970
Tools and cutlery	220	60	280	190	120	310
Bolts, nuts, screws, rivets, nails, etc.	880	210	1,090	1,650	740	2,390
Iron and steel forgings, not elsewhere specified	660	90	750	1,050	80	1,130
Wire and wire manufacturers ...	390	110	500	1,160	290	1,450
Hollow-ware	2,690	3,340	6,030	2,310	2,650	4,960
Brass manufacturers	170	50	220	250	140	390
Metal industries not elsewhere specified	5,410	3,330	8,740	6,260	4,080	10.340
PRECISION INSTRUMENTS, JEWELLERY, ETC.	1,640	1,560	3,200	2,470	2,480	4,950
Scientific, surgical and photographic instruments, etc.	1,170	740	1,910	1,700	740	2,440
Manufacture and repair of watches and clocks...	360	560	920	620	1,480	2,100
Jewellery, plate and refining of precious metals	70	200	270	70	150	220
Musical instruments	40	60	100	80	110	190

Industry	End of June 1948			End of May 1958		
	Males	Females	Total	Males	Females	Total
Textiles	7,930	4,360	12,290	10,770	5,520	16,290
Cotton spinning, doubling, etc. ...	—	10	10	10	10	20
Cotton weaving, etc.	70	370	440	70	420	490
Woollen and worsted	350	350	700	310	420	730
Rayon, nylon, etc. production ...	6,020	2,130	8,150	7,400	1,620	9,020
Rayon, nylon, etc. weaving and silk...	340	220	560	1,500	980	2,480
Linen and soft hemp	10	—	10	—	—	—
Jute	—	—	—	—	—	—
Rope, twine and net...	70	150	220	40	100	140
Hosiery, and other knitted goods ...	420	600	1,020	540	870	1,410
Lace	20	—	20	—	—	—
Carpets	—	—	—	70	50	120
Narrow fabrics	30	110	140	220	310	530
Made-up textiles	200	350	550	280	540	820
Textile finishing, etc.	170	30	200	270	160	430
Other textile industries	230	40	270	60	40	100
Leather, Leather Goods and Fur...	1,000	650	1,650	1,080	890	1,970
Leather (tanning and dressing) and fellmongery	630	220	850	800	200	1,000
Leather goods	350	410	760	120	600	720
Fur	20	20	40	160	90	250
Clothing	2,680	8,700	11,380	2,470	12,240	14,710
Tailoring	950	4,270	5,220	1,170	6,110	7,280
Dressmaking	90	970	1,060	90	1,810	1,900
Overalls, sbirts, underwear, etc. ...	240	1,690	1,930	170	2,300	2,470
Hats, caps and millinery	10	230	240	—	—	—
Dress industries not elsewhere specified...	220	1,000	1,220	270	1,260	1,530
Manufacture of boots, shoes slippers and clogs (excluding rubber) ...	280	420	700	280	670	950
Repair of boots and sboes	890	120	1,010	490	90	580
Food, Drink and Tobacco	14,000	6,750	20,750	14,930	10,340	25,270
Grain milling	1,470	430	1,900	1,070	290	1,360
Bread and flour confectionery ...	5,370	1,950	7,320	4,460	2,880	7,340
Biscuits	530	760	1,290	780	1,700	2,480
Meat and meat products	380	130	510	760	380	1,140
Milk products	1,510	530	2,040	2,100	740	2,840
Sugar and glucose	20	—	20	10	—	10
Cocoa, chocolate and sugar confectionery	300	620	920	570	1,020	1,590
Preserving of fruit and vegetables ...	60	290	350	220	930	1,150
Food industries not elsewhere specified	280	190	470	240	190	430
Brewing and malting	2,750	820	3,570	2,670	710	3,380
Wholesale bottling	540	240	780	760	500	1,260
Other drink industries	760	490	1,250	1,250	620	1,870
Tobacco	30	300	330	40	380	420

Industry	End of June 1948			End of May 1958		
	Males	Females	Total	Males	Females	Total
MANUFACTURERS OF WOOD AND CORK	5,620	720	6,340	5,630	940	6,570
Timber (sawmilling, etc)	3,110	170	3,280	2,460	200	2,660
Furniture and upholstery	1,850	430	2,280	2,070	570	2,640
Shop and office fitting	70	20	90	180	50	230
Wooden containers and baskets ...	280	40	320	660	90	750
Miscellaneous wood and cork manufacturers	310	60	370	260	30	290
PAPER AND PRINTING	4.460	2,040	6,500	6,470	2,990	9,460
Paper and board	1,490	660	2,150	2,420	740	3,160
Wallpaper	—	—	—	10	—	10
Cardboard boxes, cartons and fibreboard packing cases	60	250	310	640	760	1,400
Manufacturers of paper and board not elsewhere specified	10	40	50	80	110	190
Printing and publishing of newspapers and periodicals	1,170	250	1,420	1,880	530	2,410
Other printing and publishing, bookbinding, engraving, etc. ...	1,730	840	2,570	1,440	850	2,290
OTHER MANUFACTURING INDUSTRIES	2,130	3,350	5,480	5,560	4,950	10,510
Rubber	370	190	560	2,670	1,130	3,800
Linoleum, leather cloth, etc. ...	—	10	10	300	40	340
Brushes and brooms	270	210	480	270	380	650
Toys, games and sports requisites ...	430	1,490	1,920	1,030	2,230	3,260
Miscellaneous stationers' goods ...	80	160	240	160	190	350
Production and printing of cinematograph films	40	—	40	—	—	—
Miscellaneous manufacturing industries	940	1,290	2,230	1,130	980	2,110
BUILDING AND CONTRACTING... ...	64,940	1,090	66,030	60,230	1,830	62,060
Building	45,470	620	46,090	38,880	1,060	39,940
Electric wiring and contracting ...	2,260	220	2,480	3,340	310	3,650
Civil engineering contracting ...	17,210	250	17,460	18,010	460	18,470
GAS, ELECTRICITY AND WATER SUPPLY	12,630	1,050	13,680	18,390	2,220	20,610
Gas	3,990	240	4,230	4,040	610	4,650
Electricity	7,780	790	8,570	12,970	1,560	14,530
Water	860	20	880	1,380	50	1,430
TRANSPORT AND COMMUNICATION ...	82,050	9,350	91,400	75,610	9,490	85,100
Railways	34,900	1,570	36,470	32,080	1,240	33,320
Tramway and omnibus service ...	11,430	1,240	12,670	11,150	2,010	13,160
Other road passenger transport ...	740	50	790	700	60	760
Goods transport by road	5,620	310	5,930	6,690	570	7,260
Sea transport	9,230	260	9,490	7,070	200	7,270
Port river and canal transport ...	5,330	30	5,360	4,390	80	4,470
Harbour, dock, canal, conservancy, etc., service	4,250	200	4,450	3,670	230	3,900
Air transport	270	60	330	390	60	450
Postal, telegraph and wireless communication	9,410	5,350	14,760	8,670	4,830	13,500

Industry	End of June 1948			End of May 1958		
	Males	Females	Total	Males	Females	Total
TRANSPORT AND COMMUNICATION—(*Continued*)						
Other transport and Communication	610	270	880	610	200	810
Storage	260	10	270	190	10	200
DISTRIBUTIVE TRADES	43,490	39,220	82,710	42,910	50,500	93,410
Dealing in coal, builders' materials, grain and agricultural supplies (wholesale or retail)	5,230	980	6,210	5,730	1,750	7,480
Dealing in other industrial materials and machinery	2,870	770	3,640	3,020	600	3,620
Wholesale distribution of food and drink	4,590	1,900	6,490	4,240	2,020	6,260
Retail distribution of food and drink (excluding catering)	14,300	11,940	26,240	12,020	15,050	27,070
Wholesale distribution of non-food goods	3,290	1,970	5,260	3,900	2,640	6,540
Retail distribution of non-food goods	12,570	20,400	32,970	13,440	27,170	40,610
Retail distribution of confectionery, tobacco and newspapers	640	1,260	1,900	560	1,270	1,830
INSURANCE, BANKING AND FINANCE ...	7,260	3,200	10,460	7,810	5,280	13,090
PUBLIC ADMINISTRATION AND DEFENCE	50,810	19,260	70,070	50,010	16,420	66,430
National government service ...	20,320	9,990	30,310	15,020	6,080	21,100
Local government service	30,490	9,270	39,760	34,990	10,340	45,330
PROFESSIONAL SERVICES	20,960	37,410	58,370	26,320	49,980	76,300
Accountancy...	1,150	750	1,900	1,060	920	1,980
Education	9,720	18,900	28,620	13,350	22,210	35,560
Law	840	1,300	2,140	800	1,680	2,480
Medical and dental services... ...	6,150	15,380	21,530	8,940	23,980	32,920
Religion	660	520	1,180	170	230	400
Other professional and business services	2,440	560	3,000	2,000	960	2,960
MISCELLANEOUS SERVICES	17,960	55,560	73,520	15,230	51,530	66,760
Theatres, cinemas, music halls, concerts, etc.	2,610	3,380	5,990	2,550	3,310	5,860
Horse and dog racing, golf and other sport	920	200	1,120	580	260	840
Other recreations	730	180	910	490	290	780
Betting	960	2,060	3,020	580	2,680	3,260
Catering, hotels, etc.	7,130	24,790	31,920	7,260	27,870	35,130
Laundries	990	3,540	4,530	920	2,920	3,840
Dry cleaning, job dyeing, carpet beating, etc.	240	760	1,000	460	1,690	2,150
Hairdressing and manicure... ...	490	1,420	1,910	310	1,580	1,890

Industry	End of June 1948			End of May 1958		
	Males	Females	Total	Males	Females	Total
MISCELLANEOUS SERVICES—(*Continued*)						
Private domestic service (resident)	390	10,020	10,410	230	3,430	3,660
Private domestic service (non-resident)	870	7,970	8,840	560	6,350	6,910
Other services	2,630	1,240	3,870	1,290	1,150	2,440
EX-SERVICE PERSONNEL NOT CLASSIFIED BY INDUSTRY...	8,080	230	8,310	750	40	790
GRAND TOTAL	684,780	234,750	919,530	683,000	269,000	952,000

Appendix H

Young persons (boys) entering employment in Wales

1957

	Apprenticeship to Skilled Craft		Employment leading to Recognised Professional Qualifications		Entering Clerical Employment		Entering other Employment		Total aged 15-17
	Aged 15	Aged 16-17	Aged 15	Aged 16-17	Aged 15	Aged 16-17	Aged 15	Aged 16-17	
Agriculture, forestry and fishing	19	11	—	1	1	—	1,108	259	1,399
Mining and quarrying ...	137	117	12	—	19	21	1,401	74	1,781
Non-metalliferous mining products	14	5	—	1	4	6	254	14	298
Chemicals and allied trades ...	22	29	2	11	6	7	36	12	125
Metal manufacture	90	116	1	1	24	27	564	67	890
Engineering, shipbuilding, electrical goods	232	166	1	1	18	6	367	30	821
Vehicles	321	106	1	2	24	6	358	28	846
Metal goods	53	39	—	—	7	4	333	20	456
Precision instruments, jewellery, etc.	18	4	—	—	2	—	53	3	80
Textiles	18	15	—	2	2	3	95	9	144
Leather, leather goods and fur	—	—	—	—	1	—	63	5	69
Clothing (including footwear)	24	4	—	—	2	2	116	8	156
Food, drink and tobacco ...	35	8	—	—	8	5	425	37	518
Manufacture of wood and cork...	43	8	—	—	—	3	157	6	217
Paper and printing	51	9	1	2	11	4	111	11	200
Other manufacturing industries	10	2	—	—	3	4	104	8	131
Building and contracting ...	540	49	3	1	12	12	490	42	1,149
Gas, electricity and water ...	66	38	—	2	1	12	16	1	136
Transport and communication	38	51	1	2	59	59	316	47	573
Distributive trades	132	40	3	2	61	38	1,801	165	2,242
Insurance, banking and finance	2	3	—	5	1	43	5	4	63
Public administration ...	61	49	2	7	20	81	93	42	355
Accountancy	4	7	1	9	2	16	—	—	39
Medical and dental services...	2	4	—	1	2	5	5	1	20
Other professional services ...	7	18	2	6	8	7	13	5	66
Miscellaneous services ...	46	11	1	—	6	2	246	45	357
Total—all industries and services	1,985	909	31	56	304	373	8,530	943	13,131

Appendix J

Young persons (girls) entering employment in Wales

1957

	Apprentice-ship to Skilled Craft		Employment leading to Recognised Professional Qualifi-cations		Entering Clerical Employment		Entering other Employment		Total aged 15-17
	Aged 15	Aged 16-17	Aged 15	Aged 16-17	Aged 15	Aged 16-17	Aged 15	Aged 16-17	
Agriculture, forestry and fishing	—	3	3	2	15	7	84	46	160
Mining and quarrying	—	2	—	2	8	28	3	3	46
Non-metalliferous mining products	—	—	1	—	17	8	21	1	48
Chemicals and allied trades	2	2	—	1	22	26	46	3	102
Metal manufacture	1	1	2	—	41	73	28	4	150
Engineering, shipbuilding, electrical goods	—	4	—	—	99	85	206	17	411
Vehicles	1	—	1	1	61	60	64	5	193
Metal goods	1	2	—	—	39	31	212	11	296
Precision instruments, jewellery, etc.	1	—	—	—	13	11	103	4	132
Textiles	1	—	—	1	16	20	217	26	281
Leather, leather goods and fur	—	—	—	—	5	3	73	2	83
Clothing (including footwear)	21	1	1	—	28	16	1,299	23	1,389
Food, drink and tobacco	5	4	—	—	42	25	365	28	469
Manufacture of wood and cork	1	—	—	—	10	9	17	4	41
Paper and printing	5	—	—	—	25	22	132	1	185
Other manufacturing industries	—	—	—	—	32	31	261	12	336
Building and contracting	1	1	—	—	34	31	10	1	78
Gas, electricity and water	—	—	—	—	9	30	3	—	42
Transport and communication	—	3	1	1	72	64	27	15	183
Distributive trades	16	13	—	3	491	248	3,449	367	4,587
Insurance, banking and finance	1	1	—	2	83	144	1	3	235
Public administration	1	5	—	3	42	198	12	11	272
Accountancy	—	—	—	1	44	30	—	1	76
Medical and dental services	10	61	4	56	19	31	45	102	328
Other professional services	1	7	1	15	117	105	33	36	315
Miscellaneous services	185	29	3	—	240	70	979	160	1,666
Total—all industries and services	254	139	17	88	1,624	1,406	7,690	886	12,104

Appendix K

Young persons (boys) entering employment in Wales

1958

	Apprenticeship to Skilled Craft		Employment leading to Recognised Professional Qualifications		Entering Clerical Employment		Entering other Employment		Total aged 15-17
	Aged 15	Aged 16-17	Aged 15	Aged 16-17	Aged 15	Aged 16-17	Aged 15	Aged 16-17	
Agriculture, forestry and fishing	33	9	—	2	1	—	1,175	251	1,471
Mining and quarrying ...	79	95	—	1	11	25	943	36	1,190
Non-metalliferous mining products	15	15	1	1	—	1	207	8	248
Chemicals and allied trades ...	16	29	—	4	10	5	38	22	124
Metal manufacture	66	131	2	4	26	26	316	33	604
Engineering, shipbuilding, electrical goods	152	139	—	2	23	17	344	41	718
Vehicles	358	97	2	3	12	9	430	36	947
Metal goods	42	31	1	1	6	12	332	23	448
Precision instruments, jewellery, etc.	9	4	—	1	—	—	51	10	75
Textiles	10	17	—	3	—	—	73	7	110
Leather, leather goods and fur	—	—	—	—	—	—	41	5	46
Clothing (including footwear)	12	3	—	1	—	1	170	2	189
Food, drink and tobacco ...	39	9	—	1	12	8	442	29	540
Manufacture of wood and cork...	32	6	—	—	3	—	145	6	192
Paper and printing	39	6	—	1	9	6	109	18	188
Other manufacturing industries...	5	4	—	—	3	5	141	13	171
Building and contracting ...	490	84	5	1	11	15	696	59	1,361
Gas, electricity and water ...	71	56	1	2	1	6	15	4	156
Transport and communication	48	60	—	3	33	33	189	45	411
Distributive trades	144	40	4	4	53	41	2,059	206	2,551
Insurance, banking and finance	1	1	—	4	4	59	3	5	77
Public administration ...	61	49	7	7	7	109	123	45	408
Accountancy	—	13	—	12	5	15	2	1	48
Medical and dental services...	6	2	—	4	1	4	5	6	28
Other professional services ...	10	21	5	8	4	13	18	9	88
Miscellaneous services ...	40	7	1	—	8	5	300	45	406
Total—all industries and services	1,778	928	29	70	243	415	8,367	965	12,795

Appendix L

Young persons (girls) entering employment in Wales

1958

	Apprenticeship to Skilled Craft		Employment leading to Recognised Professional Qualifications		Entering Clerical Employment		Entering other Employment		Total aged 15-17
	Aged 15	Aged 16-17	Aged 15	Aged 16-17	Aged 15	Aged .16-17	Aged 15	Aged 16-17	
Agriculture, forestry and fishing	1	2	—	—	4	6	101	29	143
Mining and quarrying ...	—	—	—	—	15	12	4	1	32
Non-metalliferous mining products	—	—	—	—	15	9	18	1	43
Chemicals and allied trades ...	1	4	—	1	16	27	49	3	101
Metal manufacture	—	3	—	—	33	67	31	9	143
Engineering, shipbuilding, electrical goods	—	5	1	—	72	78	191	13	360
Vehicles	1	1	1	1	70	42	76	10	202
Metal goods	1	1	—	—	28	26	229	7	292
Precision instruments, jewellery, etc.	1	1	—	—	13	8	93	11	127
Textiles	1	4	1	1	14	40	213	11	285
Leather, leather goods and fur	—	—	—	—	2	4	65	1	72
Clothing (including footwear)	13	3	—	—	22	12	1,133	25	1,208
Food, drink and tobacco ...	5	4	—	—	43	26	347	34	459
Manufacture of wood and cork...	2	1	—	—	14	9	11	2	39
Paper and printing	3	1	—	—	26	11	136	4	181
Other manufacturing industries...	—	—	—	2	21	31	301	8	363
Building and contracting ...	1	3	—	—	35	22	12	1	74
Gas, electricity and water ...	1	—	—	—	16	19	2	2	40
Transport and communication	1	—	—	1	36	51	25	8	122
Distributive trades	16	9	3	3	512	240	3,272	398	4,453
Insurance, banking and finance	—	2	—	1	84	172	5	5	269
Public administration ...	2	7	5	32	37	321	43	59	506
Accountancy	—	1	—	3	37	53	2	2	98
Medical and dental services...	4	48	9	102	22	49	35	101	370
Other professional services ...	1	—	—	2	93	92	11	13	212
Miscellaneous services ...	190	37	1	3	345	111	1,065	144	1,896
Total—all industries and services	245	137	21	152	1,625	1,538	7,470	902	12,090

Appendix N

Some Statistics relating to the General Certificate of Education (Advanced Level) Examinations of the Welsh Joint Education Committee for 1954 *and* 1958

Subject	Boys						Girls					
	1954			1958			1954			1958		
	Entries	Percentage of all Advanced Level Candidates (Boys)	Passes as Percentage of Entries	Entries	Percentage of all Advanced Level Candidates (Boys)	Passes as Percentage of Entries	Entries	Percentage of all Advanced Level Candidates (Girls)	Passes as Percentage of Entries	Entries	Percentage of all Advanced Level Candidates (Girls)	Passes as Percentage of Entries
Pure and Applied Mathematics	435	25·8	69·7	639	27·4	65·7	42	4·4	66·7	83	5·8	74·7
Pure Mathematics	175	10·4	63·4	280	12·0	68·2	44	4·6	77·3	45	3·1	71·7
Applied Mathematics ...	115	6·8	72·2	212	9·1	73·1	30	3·2	76·7	39	2·7	66·7
Physics	760	45·2	68·3	980	42·1	63·8	118	12·5	56·8	165	11·6	60·0
Chemistry	752	44·7	64·9	900	38·7	64·3	205	21·6	61·0	221	15·5	60·6

Appendix O

Some Statistics relating to the General Certificate of Education (Ordinary Level) Examinations of the Welsh Joint Education Committee for 1954 and 1958

Subject	Boys						Girls					
	1954			1958			1954			1958		
	Entries	Percentage of all Ordinary Level Candidates (Boys)	Passes as Percentage of Entries	Entries	Percentage of all Ordinary Level Candidates (Boys)	Passes as Percentage of Entries	Entries	Percentage of all Ordinary Level Candidates (Girls)	Passes as Percentage of Entries	Entries	Percentage of all Ordinary Level Candidates (Girls)	Passes as Percentage of Entries
Mathematics	3,911	64·1	66·0	4,700	62·1	57·9	2,066	35·3	58·9	2,631	38·9	55·4
Physics	2,392	39·2	58·2	3,056	40·3	55·9	534	9·1	54·5	811	12·0	57·6
Chemistry	2,346	38·4	59·3	2,816	37·2	58·2	985	16·8	51·1	1,254	18·6	53·5
Biology	1,355	22·2	59·8	1,576	20·9	56·3	2,262	38·7	56·5	2,673	39·6	55·0

Appendix P

List of Persons and Organisations who submitted evidence

Those who gave evidence orally:

A. Representing Industrial Organisations

Mr. G. I. Atkins	Assistant Area General Manager, Area No. 5 (North Wales), North Western Division, National Coal Board.
Mr. W. H. Ashworth	Manpower and Welfare Officer, Area No. 4, South Western Division, National Coal Board.
Mr. T. S. Batho	Training Officer, Esso Refinery, Fawley.
Mr. W. E. Beaverstock	Penmaenmawr and Welsh Granite Co. Ltd., Penmaenmawr.
Mr. C. L. Boult	Managing Director, Anglo-Celtic Watch Co. Ltd., Ystradgynlais.
Mr. Bluet	Richard Thomas and Baldwins Ltd. Gorseinon.
Commander R. A. Bristowe	Milford Haven Docks Company.
Dr. J. G. M. Bremner	Works Manager, Imperial Chemical Industries Ltd., Dowlais.
Mr. W. Brown	Education and Welfare Officer, Richard Thomas and Baldwin Ltd., Ebbw Vale.
Mr. A. S. Brown	Director and General Manager, Aberdare Engineering Ltd., Aberdare.
Mr. E. Butterworth	Director of Labour and Welfare, Central Electricity Generating Board, Merseyside and North Wales Region.
Mr. H. W. Carter	Secretary, Central Electricity Generating Board, South Wales Division.
Mr. K. S. Chard	Imperial Chemical Industries (Metals) Ltd., Waunarlwydd, Swansea.
Mr. H. Chatfield	Area Staff Manager, Area No. 4, South Western Division, National Coal Board.
Mr. J. C. Corby, O.B.E.	General Manager, de Havilland Aircraft Co. Ltd., Broughton, Chester.
Mr. E. Coupland	Chief Engineer, Rubery Owen & Co. Ltd., Wrexham.
Mr. R. Coverdale	Executive Development Officer, Steel Company of Wales, Port Talbot.
Mr. H. D. Crayford	Divisional Secretary, The Motor Agents' Association, Swansea.
Mr. K. D. M. Dauncey	Personnel Superintendent, Steel Company of Wales, Port Talbot.
Mr. E. V. Davies	S. Davies & Son, Builders, Briton Ferry.
Mr. E. Davies	Works Director, Brymbo Steel Works Ltd., Wrexham.
Mr. G. Davison	Area Staff Training Officer, Area No. 1, South Western Division, National Coal Board.

Mr. S. G. Deane	Personnel Manager, Standard Telephones and Cables Ltd., Newport.
Mr. S. M. Doble	Works Manager, Associated Ethyl Co. Ltd., Amlwch.
Mr. D. G. Dodds	Secretary, South Wales Electricity Board.
Mr. J. B. Drongeson	Chairman, South Wales Regional Advisory Committee, Trade Union Congress.
Mr. C. B. Evans	Works Manager, Midland Silicones Ltd., Barry.
Commander Farquhar	Milford Haven Docks Company.
Mr. Glanville	E.M.I. Electronics Ltd., Treorchy.
Mr. W. E. Gowers	Director and General Manager, Girling Ltd., Cwmbran.
Major A. S. D. Graesser, M.C.	Director, R. Graesser Ltd., The Chemical Works, Sandycroft, Chester.
Mr. Griffiths	Deputy Manager, Cookes Explosives Ltd., Penrhyndeudraeth.
Mr. R. L. Hancock	Managing Director, Hancock's Shipbuilding Co., Pembroke Dock.
Mr. Forbes Hayes	Managing Director, Sheppard & Sons Ltd., Structural and General Engineers, Bridgend.
Mr. F. Hill	Builder, Newport.
Mr. T. M. Houston	Personnel Manager, Monsanto Chemicals Ltd., Ruabon.
Mr. H. J. Hurst	General Manager, Reynolds T. I. Aluminium Ltd., Resolven.
Mr. H. T. Huxley-Turner	Director, E. Turner & Sons Ltd., Builders & Contractors, Cardiff.
Mr. R. James	South Wales Electricity Board.
Mr. H. W. John	Establishment Officer, Central Electricity Generating Board, South Wales Division.
Mr. J. A. Johnson	Manager, Courtaulds Ltd., Holywell.
Mr. T. Jolly	Managing Director, Guest Keen Iron and Steel Co. Ltd., Cardiff.
Sir Lewis Jones	South Wales Siemens Steel Association, Swansea.
Mr. D. Jones	Personnel Manager, Saunders-Roe (Anglesey) Ltd., Beaumaris.
Mr. J. L. H. Ladner	Education and Training Officer, Merseyside and North Wales Electricity Board.
Mr. G. Loasby	Director, British Nylon Spinners Ltd., Pontypool.
Mr. I. S. Malcolm	Education and Training Officer, Hoover (Washing Machines) Ltd., Merthyr Tydfil.
Mr. Mainwaring	Employers' Secretary, Joint Apprenticeship Board for the Building Industry, Swansea Area.
Mr. A. R. Martin	Education and Training Officer, Central Electricity Generating Board, South Wales Division.

Mr. W. F. F. Martin-Hurst	Managing Director, Teddington Aircraft Controls Ltd., Merthyr Tydfil.
Dr. H. Mastin	British Aluminium Co. Ltd., Newport.
Mr. N. McPherson	Manager, Aluminium Corporation Ltd., Dolgarrog.
Mr. J. B. Moller	Distillers Co. Ltd., Kenfig Factory, Port Talbot.
Mr. R. P. Moore	President, South Wales and Monmouthshire Federation of Building Trades Employers.
Mr. D. T. Morgan	Chairman, The Motor Agents' Association, Swansea Area.
Mr. H. T. Norton	Member of the Chamber of Commerce, Cardiff.
Mr. W. T. Owen	Education and Training Officer, Whitehead Iron and Steel Co. Ltd., Newport.
Mr. L. G. Oxford	Managing Director, Simmonds Aerocessaries Ltd., Treforest.
Mr. G. Payne	Managing Director, Tuscan Engineering Co. Ltd., Bridgend.
Mr. S. T. Pickering	General Manager, Chance-Pilkington Optical Works, St. Asaph.
Mr. Pickup	Education Officer, Courtaulds Ltd., Holywell.
Mr. C. Prothero	Secretary, South Wales Regional Advisory Committee, Trade Union Congress.
Mr. Pudner	Works Superintendent, Marine Department, British Railways, Holyhead.
Dr. A. G. Ramsay	Director, The Mond Nickel Co. Ltd., Clydach.
Mr. D. M. Rees	Secretary and Area Training Officer, South Wales and Monmouthshire Area Training Committee, British Iron and Steel Federation.
Mr. Richards	Joint Apprenticeship Board for the Building Industry, Swansea Area.
Mr. D. W. Ritchie	Personnel Officer, The Metal Box Co. Ltd., Neath.
Mr. M. Roberts	Education and Training Officer, British Nylon Spinners Ltd., Pontypool.
Mr. E. A. Rogers	Training Officer, Steel Co. of Wales, Port Talbot.
Mr. D. J. Skidmore	Area General Manager, Area No. 6, South Western Division, National Coal Board.
Miss M. Smith	Personnel Officer, Alexon & Co. Ltd., Rhydyfelin, Pontypridd.
Mr. R. B. Southall, C.B.E.	General Manager, B. P. Refinery (Llandarcy) Ltd., Neath.
Mr. Haydn Thomas	Messrs. Gee, Walker and Slater, Builders, Bridgend.
Mr. Lister Walker	Area General Manager, Area No. 2, South Western Division, National Coal Board.
Mr. G. A. Watson	Area General Manager, Area No. 9, South Western Division, National Coal Board.

Dr. J. W. Welch ...	Director of Education, Richard Thomas & Baldwin Ltd.
Mr. A. Williams ...	Group General Manager, Denis Ferranti Meters Ltd., Bangor.
Mr. H. Williams	Area Staff Manager, Area No. 3, South Western Division, National Coal Board.
Mr. H. J. V. Williams ...	Director, John Williams & Sons Ltd., Engineers, Cardiff.
Mr. O. T. Williams	General Manager, Dinorwic Slate Quarries Co. Ltd., Port Dinorwic, Caerns.
Mr. G. Williamson	Chartered Civil and Structural Engineer Consultant, Bridgend.
Mr. T. G. Wrighton	Works Manager, Hotpoint Electric Appliance Co. Ltd., Llandudno Junction.
Mr. E. Yorath ...	Manager, Guest Keen Ltd., Dowlais.

B. *Representing Education Authorities, Educational Establishments and Associations*

Local Education Authorities

Cardiff

Councillor D. Howells	Vice-Chairman, Governing Body, Llandaff Technical College.
Mr. R. E. Presswood...	Director of Education.

Denbighshire

Mr. E. P. K. Evans ...	Vice-Chairman, Education Committee.
Mr. D. B. Jones	Vice-Chairman, Governing Body, Denbighshire Technical College.
Mr. F. H. Andleby Jones	Chairman, Governing Body, Colwyn Bay Technical Institute.
Mr. Edward Rees	Director of Education.
Mr. D. W. E. Erasmus	Further Education Officer.

Flintshire

Alderman T. Waterhouse	Chairman, Governing Body, Flintshire Technical College.
Councillor H. Ellis ...	Member, Flintshire Education Committee.
Dr. Haydn Williams ...	Director of Education.

Glamorgan

Alderman Ll. Heycock, C.B.E.	Chairman, Education Committee.
Alderman R. A. Thomas	Vice-Chairman, Education Committee.
Alderman W. Evans ...	Chairman, Governing Body, College of Further Education, Gorseinon.
Mr. W. B. Davies	Chairman, Governing Body, College of Further Education, Rhondda.
Councillor E. G. James	Chairman, Governing Body, Glamorgan College of Technology, Treforest.
Councillor R. Roberts	Chairman, Governing Body, Technical Institute, Pontardawe.
Dr. E. Stephens	Director of Education.
Mr. D. Jones-Davies ...	Education Officer, Rhondda.

Miss B. Payne	County Organiser, Youth Employment Service.
Merthyr Tydfil	
Councillor B. Watkins	Chairman, Further Education Committee.
Mr. D. Andrew Davies	Director of Education.
Montgomeryshire	
Mr. T. Glyn Davies	Director of Education.
Newport and Monmouthshire	
Alderman T. S. Mooney	Chairman, Newport and Monmouthshire College of Technology, Newport.
Alderman J. J. Panes	Vice-Chairman, Newport and Monmouthshire College of Technology, Newport.
Councillor J. A. Holley	Chairman, Monmouthshire Technical College, Crumlin.
Alderman A. E. Miles	Vice-Chairman, College of Further Education, Newport.
Alderman H. Phillips	Chairman, Further Education Sub-Committee, Monmouthshire.
Mr. T. M. Morgan	Director of Education, Monmouthshire.
Mr. W. J. Edmonds	Deputy Education Officer, Newport.
Mr. G. N. Tipping	County Organiser, Youth Employment Service, Monmouthshire.
Pembrokeshire	
Mr. Wynford Davies	Director of Education.
Swansea	
Councillor F. A. Gorst	Chairman, Education Committee.
Councillor C. E. Harries	Member, Education Committee.
Alderman S. John	Member, Education Committee.
Mr. L. J. Drew	Director of Education.
Principals of Technical Colleges	
Mr. J. Cotterell	Technical College, Llandaff.
Mr. A. L. Davies	College of Further Education, Aberdare.
Dr. D. P. Evans	Glamorgan College of Technology, Treforest.
Mr. H. Evans	College of Further Education, Gorseinon.
Mr. T. M. Evans	College of Further Education, Rhondda.
Mr. W. J. Griffiths	Technical Institute, Colwyn Bay.
Mr. F. W. R. Harrison	Newport and Monmouthshire College of Technology, Newport.
Dr. A. Harvey	Welsh College of Advanced Technology, Cardiff.
Mr. Emlyn John	College of Further Education, Merthyr Tydfil.
Dr. Islwyn Jones	Technical College, Neath.
Mr. R. Jones	College of Further Education, Port Talbot.
Dr. G. S. Lyons	Flintshire Technical College, Connah's Quay.
Mr. D. Cecil Morgan	Denbighshire Technical College, Wrexham.
Mr. T. Powell	Technical College, Bridgend.
Mr. D. L. Richards	College of Further Education, Neyland.
Dr. T. V. Starkey	Monmouthshire Technical College, Crumlin.
Mr. G. C. Sumption	Technical Institute, Bargoed.

Mr. G. Thompson	Technical College, Swansea.
Mr. T. S. Windsor	College of Further Education, Pontypool.
Mr. J. C. Winter	College of Further Education, Newport.
Heads of Departments, Constituent Colleges of the University of Wales	
Aberystwyth	
Professor W. J. G. Beynon	Physics Department.
Professor C. W. Davies	Chemistry Department.
Professor T. V. Davies	Applied Mathematics Department.
Miss D. Meyler	Senior Lecturer, Pure Mathematics Dept.
Bangor	
Professor E. R. Andrew	Physics Department.
Professor M. R. Gavin	Electronic Engineering Department.
Professor S. Peat	Chemistry Department.
Cardiff	
Professor H. C. H. Gurney	Engineering Department.
Professor W. R. D. Jones	Metallurgy and Fuel Technology Department.
Dr. J. W. Hughes	Senior Lecturer, Physics Department.
Dr. G. O. Phillips	Lecturer, Chemistry Department.
Swansea	
Professor W. Fishwick	Electrical Engineering Department.
Professor G. H. Hassell	Chemistry Department.
Professor F. Llewellyn-Jones	Physics Department.
Professor R. H. Macmillan	Mechanical Engineering Department.
Professor B. G. Neal	Civil Engineering Department.
Professor H. O'Neill	Metallurgy Department.
Professor E. S. Sellers	Chemical Engineering Department.
Welsh Secondary Schools Association	
Mr. S. Davies	Headmaster, Holywell Grammar School.
Miss M. M. Copland	Headmistress, Grove Park Grammar School for Girls, Wrexham.
Welsh Joint Education Committee	
Dr. A. C. Bassett	Examinations Officer.
Mr. D. O. Jones	Technical Officer.
Association of Teachers in Technical Institutes (South Wales Division)	
Mr. R. Smith (Secretary)	Abersychan Technical Institute.
Ministry of Labour	
Mr. G. K. Pollard	Assistant Controller, Ministry of Labour, Cardiff.
Her Majesty's Inspectors of Schools	
Mr. W. G. Lewis	
Mr. I. G. Richards	

Those who submitted written evidence

Central Electricity Generating Board
Industrial Association of Wales and Monmouthshire
South Wales Electricity Board
Welsh Board for Industry
Youth Employment Officers
Sir Geoffrey Summers
Ministry of Labour
Board of Trade

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Appendix M

An Analysis of Returns submitted by Industries in Wales in response to a Questionnaire prepared by the Council

	No. of organisations written to	No. of replies received	CRAFT APPRENTICES 1955 Vacancies	1955 Applications received	1955 Recruited	1956 Vacancies	1956 Applications received	1956 Recruited	1957 Vacancies	1957 Applications received	1957 Recruited	STUDENT APPRENTICES 1955 Vacancies	1955 Applications received	1955 Recruited	1956 Vacancies	1956 Applications received	1956 Recruited	1957 Vacancies	1957 Applications received	1957 Recruited	TECHNOLOGISTS Employed in 1957	Vacancies	Estimated annual intake 1958-62	TECHNICIANS Employed in 1957	Vacancies	Estimated annual intake 1958-62	CRAFTSMEN Employed in 1957	Vacancies	Estimated annual intake 1958-62	GRADUATE APPRENTICES Employed in 1957	Vacancies	Estimated annual intake 1958-62	STUDENT APPRENTICES Employed in 1957	Vacancies	Estimated annual intake 1958-62	CRAFT APPRENTICES Employed in 1957	Vacancies	Estimated annual intake 1958-62
Cardiff, Barry, Penarth	119	70	234	575	281	279	351	189	490	450	303	45	52	43	36	81	84	49	57	44	133	15	13	500	2	2	2,877	11	89	2	—	—	142	8	48	189	12	113
Newport and Monmouthshire	120	75	308	339	301	298	688	290	336	997	254	17	88	18	76	120	77	119	559	112	303	64	82	1,704	29	47	4,306	83	140	41	46	13	182	8	96	986	22	222
Tredegar	96	40	34	53	30	11	78	30	25	70	25	2	—	2	1	9	2	20	20	2	28	—	4	68	2	3	247	6	2	1	—	1	20	3	3	201	2	20
Caerphilly—Bargoed	13	9	42	58	38	31	50	19	32	88	42	7	10	2	1	11	2	6	20	3	9	1	1	29	2	3	271	2	13	3	1	1	9	1	1	32	1	20
Rhondda	34	26	53	53	38	25	26	19	42	68	48	2	—	2	1	—	2	3	—	3	3	—	—	1	—	—	298	—	—	—	—	—	1	—	—	60	—	2
Abercynon, Hirwaun, Mountain Ash, Aberdare	13	10	17	24	16	2	15	1	1	30	7	23	50	23	16	30	10	11	38	13	13	—	6	33	—	14	131	10	20	1	—	6	56	1	16	43	—	16
Merthyr	14	11	63	96	63	73	181	69	36	197	37	2	1	1	2	—	3	—	—	—	3	—	—	11	—	—	226	—	2	1	—	—	18	—	1	203	—	17
Neath, Resolven	20	16	85	442	85	77	499	80	79	346	74	22	26	8	11	20	15	19	52	11	111	1	2	117	1	2	1,664	8	38	—	—	—	43	8	15	336	2	70
Port Talbot	8	2	67	100	69	88	129	88	82	251	60	3	18	2	6	30	3	9	140	2	108	35	3	189	47	47	1,835	14	100	1	2	1	15	3	3	347	32	80
Bridgend, Maesteg	12	12	47	47	47	66	62	61	47	56	36	4	2	2	4	4	4	4	4	4	3	—	—	13	—	2	381	—	13	—	—	—	4	—	1	69	—	3
Swansea and Swansea Valley	38	22	105	232	105	136	496	122	109	283	110	12	2	11	11	11	11	11	33	30	69	1	2	120	1	—	981	2	4	—	—	—	34	—	12	178	8	49
Carmarthenshire	40	27	84	138	84	97	138	97	49	196	48	—	—	—	1	1	1	—	—	—	23	1	2	34	1	1	1,012	—	21	—	2	2	2	2	1	163	22	38
Pembrokeshire	4	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cardiganshire	4	1	6	—	3	1	—	1	6	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Breconshire	3	2	17	17	17	11	11	12	1	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Radnorshire	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Montgomeryshire	3	2	—	—	—	1	—	1	2	—	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	20	—	—	—	—	—	—	—	—	1	—	2
Denbighshire	23	10	12	18	11	18	31	14	16	42	11	3	—	—	1	8	—	3	3	1	12	—	1	11	—	—	418	1	12	—	—	—	2	2	—	99	1	12
Flintshire	73	15	23	403	47	47	320	48	46	231	46	2	2	3	2	6	3	3	6	3	33	1	1	123	—	3	6,918	1	2	—	—	—	11	1	4	181	—	31
Anglesey	3	2	12	—	10	14	—	14	4	—	4	—	—	—	1	1	1	—	—	—	—	—	—	—	—	—	138	—	—	—	—	—	—	—	—	58	—	10
Merioneth	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Caernarvonshire	12	2	75	48	48	81	36	81	30	64	60	1	3	1	—	—	—	1	6	1	15	—	2	29	2	—	309	3	—	—	—	—	4	—	—	169	11	20
TOTALS	602	331	1,200	3,271	1,180	1,300	3,182	1,201	1,312	2,876	1,219	129	181	149	177	266	179	188	316	241	1,112	129	152	3,096	161	202	16,892	133	434	80	49	37	654	48	202	5,129	113	697
Post Office Telephone Engineers	—	—	—	—	—	—	—	—	—	—	—	13	83	29	38	110	33	14	33	14	—	—	—	5,109	—	49	—	—	—	—	—	—	48	—	14	—	—	—
South Wales Electricity Board	—	—	70	496	70	67	502	67	81	243	81	20	30	13	20	29	13	20	45	15	909	—	—	190	—	—	1,398	—	—	2	2	2	74	13	13	135	67	67
Merseyside and North Wales Electricity Board	—	—	41	144	41	51	150	53	20	181	18	—	19	—	—	13	1	—	38	—	—	—	—	185	6	—	719	—	—	—	—	—	6	—	—	106	—	—
Central Electricity Generating Board (South Wales Division)	—	—	10	198	10	10	36	11	20	105	20	11	65	9	15	80	12	13	119	25	—	—	—	112	10	23	261	—	28	4	6	2	20	—	20	65	—	19
Wales Gas Board	—	—	25	—	25	33	—	33	31	—	31	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
British Transport Commission (Western Region) South Wales Area	—	—	62	112	62	58	151	58	64	116	64	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1,400	127	173	—	—	—	—	—	—	289	49	—
British Transport Commission (London Midland Region) (North Wales Area)	—	—	1	17	1	3	19	1	1	19	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	104	20	20	—	—	—	—	—	—	28	—	3
British Road Services (Western Division)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	70	—	—	—	—	—	—	—	—	—	—	—
National Coal Board (North Wales Area)	—	—	20	58	14	20	47	19	77	87	21	—	—	—	—	—	—	—	—	—	39	—	1	431	—	11	238	—	—	—	—	—	—	1	1	120	—	34
National Coal Board (South Wales Area)	—	—	180	229	170	240	240	240	229	213	212	—	—	—	—	—	—	44	111	38	1,650	—	—	—	—	—	3,000	—	—	—	—	—	29	—	50	794	—	200
TOTALS	—	—	422	1,389	404	482	1,678	482	317	1,643	311	57	205	45	81	244	53	108	386	76	4,128	—	1	2,270	16	35	9,162	146	151	6	8	2	207	14	79	1,644	96	149
GRAND TOTALS	—	—	1,542	4,437	1,684	1,810	4,660	1,781	1,986	1,195	1,378	203	176	194	170	510	244	298	1,028	317	5,240	119	153	2,364	190	287	17,309	500	585	69	55	64	861	88	281	6,683	209	1,000